ENGINEERING NEWS

AT its last session in Cleveland, on Aug. 21, the American Association for the Advancement of Science selected as its officers for the year 1889 the following gentlemen:—President, T. C. MENDENHALL, of Terre Haute, Ind.; Vice-Presidents, A. Mathematics and Astronomy, R. S. WOODWARD, of Washington, D. C.; B. Physics, H. S. CARHART, of Ann Arbor, Mich.; C. Chemistry, WILLIAM L. DUDLEY, of Nashville, Tenn.; D. Mechanical Science and Engineering, ARTHUR BEARDSLEY, of Swarthmore, Pa.; E. Geology and Geography, CHARLES A. WHITE, of Washington; F. Biology, GEORGE L. GOODALE, of Cambridge, Mass.; H. Anthropology, GARRICK MALLERY, of Washington; I. Economic Science and Statistics, CHARLES S. HILL, of Washington.

Permanent Secretary, F. W. PUTNAM, of Cambridge, Mass., (office Salem, Mass.)—Holds over. General Secretary, C. LEO MEES, of Terre Haute, Ind. Secretary of the Council, FRANK BAKER, of Washington, Mass.; THOMAS MEEHAN, of Germantown, Pa.

AN item of interest to makers of American machinery is the fact that the newest ocean racer, the *City of New York*, is fitted out with no less than 16 Worthington pumps of all kinds; and the new *City of Paris*, has a like number aboard. The *City of New York* was also the first English ocean steamship fitted out at the start with independent boiler feed pumps, an innovation in direct opposition to the usual English practice.

THE work on the new Boston-Cambridge or Harvard bridge is progressing rapidly, five of the piers being above the water surface and five others near to it. The contract for these piers was let on Aug. 20, 1887, to SHIELDS & CARROLL for $122,820 and the first pile was driven on Sept. 15, 1887. There will be 23 of these piers, each about 70 ft. by 5 ft. at top. Preparations are now being made to swing the arched plate girders by means of a traveling wooden Howe truss. The completed bridge will be about 2,100 ft. long and 70 ft. wide, with a draw-span. The Boston Bridge Co. has the contract for the superstructure at $185,050 and $11,700 for the draw span. WM. H. WARD will build the masonry abutments for $15,900, and the foundation and pier of the draw-span is let to BOYNTON BROS., for $26,875. It is expected that the bridge will be completed by Jan. 1, next.

THE Pennsylvania R. R. Co. has brought a suit for damages to the modest amount of $5,210,000 against the Staten Island Rapid Transit Company. This is the old fight over the Arthur Kill bridge, between Staten Island and New Jersey, and the Baltimore & Ohio R. R. Co. is the real defendant in the case. The complaint is that this bridge obstructs navigation and has caused damage to the Pennsylvania Company to the amount of $210,000, with prospective damages of $5,000,000. The point is also raised that while there was apparent legal authority for building the bridge, it was not built upon approved plans and hence is an obstruction. In opposition to this last point the Staten Island Company cites the decision of Justice BRADLEY, in the case of the State of New Jersey against the bridge, in which it was decided that the act of Congress gave full authority for the construction of the bridge, and that it was a lawful structure. The real battle is over the entrance of the Baltimore & Ohio R. R. into the vicinity of New York *via* the New Jersey Central R. R.

THE Board of Electrical Control asked the Board of Alderman of New York this week to pass an ordinance requiring the removal of all poles and wires from the streets, and also charged that the United States Illuminating Company is a persistent offender in the direction of refusing to use the conduits. The company referred to, reply to this charge by countercharging that the Board is run by the Subway Company, a private corporation. And that while the U. S. Co. has no authority to open the streets, the subways put at their disposal are small iron pipes full of moisture and only open at the intersection of streets; that they cannot be tapped at intermediate points and that the company have failed to lay subways to the different points required in their distribution of electric light.

THE New York & Long Island Railroad Company, which wishes to build a tunnel under the East River and an underground railway beneath New York City, refuses to submit to the action of the Board of Aldermen taken last Spring, refusing the Company a franchise, as final. The application for permission to proceed with its construction has been amended, and President ROY STONE, Chief Engineer OLIVER W. BARNES, and other officers of the company have again brought it before the Committee on Bridges and Tunnels.

THE Chicago West Division Elevated Railroad Company has filed its charter in Illinois. The line is to start in the business district of the south side, cross the river by a tunnel between Harrison and Lake streets, and run several branches to the west division. The first board of directors includes ANDREW ONDERDONK of New York City, JAS. ROSS of Sherbrooke, P. Q., WM. D. HOWARD, JAS. DEERING, and WM. G. MCCORMICK of Chicago.

ON Aug. 26 at 2 P. M. the locomotive engineers, fireman and brakemen of the Peoria, Decatur & Evansville Railway struck work, on the ground of unjust treatment at the hands of Master Mechanic F. C. SMITH. A conference was held by the grievance committee with President MACKEY; at which it is stated the latter promised an investigation of the charges against Mr. SMITH, and the strike was declared off and work was resumed on the following morning, after a stoppage of 12 hours.

THE following applications are pending before the New York Stock Exchange for the listing of new bond issues: Chicago, Rock Island & Pacific 5's $1,000,000. Illinois Central 4's, $2,500,000. Missouri Pacific 4's, $7,000,000. Mobile & Birmingham 5's, $3,000,000. Norfolk & Western Clinch Valley extension, $849,000.

THERE is a city law in Philadelphia forbidding the opening of the streets for any purpose during the late Fall and Winter months. As a consequence there is great activity just now in the way of contracts for laying conduits for the electric light companies.

THE Carbon Iron Co., of Pittsburg, Pa., write us that they have completed their open-hearth steel plant, referred to in our issue of Aug. 4, using two 15 ton furnaces, and they are now making steel. The large universal mill will be in operation after Sept. 1, and from that date they can furnish universal rolled steel plates up to 36 in. in width and of any length or thickness required for structural purposes. Their output will also include slabs, from 6 ins. to 30 ins. wide and from 2 ins. to 6 ins. thick, and blooms from 4 to 8 ins. square.

Mr. GEORGE H. COOK, State Geologist of New Jersey, announces that in order to meet the constantly increasing demand for the Atlas of New Jersey, (so frequently referred to in this journal), the Board of Managers of the Geological Survey have decided to allow them to be sold at the uniform price of 25 cts. per sheet, either singly or in lots. This is about the cost of the paper and printing, but also covers the cost of the postage or expressage. Applications should enclose the money and be directed to Mr. IRVING S. UPSON, New Brunswick, N. J. There are 18 maps in all and a list can be obtained from the same gentleman, giving the region covered by each sheet, by enclosing return postage.

THE Conference Committee of the American Institute of Architects, the Western Association of Architects and the National Association of Builders, appointed at the last annual conventions of these societies to present a standard form of contract to be received and generally adopted by architects and builders, have sent out a specimen copy of such contract. It can be obtained of the *Inland Publishing Co.*, 19 Tribune Building, Chicago, Ill.

THE city of Paris has voted the sum of 20,000 francs to be distribed as prizes for electric meters; 10,000 francs to the inventor of the meter giving the best satisfaction, and five prizes of 2,000 francs each to the next best meters. The city reserves the right to manufacture the adopted meter without further payment.

THE plans for the proposed ship canal between Birmingham and Liverpool, according to the London *Engineer*, contemplate a strong, concreted channel 60 ft. wide and 11 ft. deep, navigable for vessels of 300 tons burden. The cost is estimated at $8,000,000; and the out-going traffic alone is set down at 2,000,000 tons per annum, which at an average rate of 4s. per ton would yield a dividend of 16½ per cent. on the capital. As our contempory remarks the financial prospects of the company are bright enough on—paper.

Herr GRIESS, in the *Berichte der Deutchen Chemischen Gesellschaft*, (XXI. No. 9) suggests the use of para-diazo-benzol-sulphuric acid for the detection of organic impurities in water. An alkaline solution of this compound gives a yellow or orange color with uric acid; and one part of human urine in 5,000 or one part of horse urine in 50,000 parts of water can be accurately and certainly detected and estimated. The diazo solution is made by dissolving one part of para-diazo-sulphuric acid in 100 parts of water, and adding Na OH solution until slightly alkaline. It must be used quite fresh by adding a few drops of the solution to 100 c.c. of water. If after standing 5 minutes no color forms, the water may be considered to be pure.

AN English inventor, a Mr. G. C. RICE, is explaining in a pamphlet his patent "ancillary railway carriage". His principal purpose is to alter the car now in use so that it can be converted at will either into a car with seats or one to stand in without seats. For the "greater comfort" of standing passengers he adds perpendicular bars extending from the floor to the roof. Hanging on to a car-strap in a crowded aisle is bad enough; but the device of Mr. RICE suggests a more exquisite discomfort that will hardly be popular.

THE past week has not presented any railway accidents of especial importance, though there have been the usual number of minor accidents. The most serious was the derailment of a gravel train on the Ohio River road, about 7 miles from Wheeling, W. Va., on Aug 24. The train, which carried a number of laborers, went down a 30 ft. bank. Several men were injured, but only three seriously.

THE following bridge accidents are reported: On Aug. 35 about 50 ft. of trestle on the West Shore Railway, at the Genesee river, near Genesee Junction, N. Y., was destroyed by fire.—On Aug. 26 the timber false-works of the iron bridge being built for the Chesapeake & Ohio Ry., across the Ohio river between Cincinnati, O., and Covington, Ky., was carried away by an accumulation of drift wood.

THE model for the statue of WILLIAM PENN, which is to surmount the new Public Buildings in Philadelphia, now stands complete in the studio of the sculptor, Mr. A. M. CALDER. The bronze statue when cast will be 37 ft. high, the largest of its class in the world. The nearest approach to it is the Statue of HERMANN, in Germany, 34 ft. high.

OMAHA capitalists are reported to be interested in a supposed oil field of immense proportions in the Rattlesnake and Beaver mountains in Wyoming, and a scheme for piping it to that city. The distance is estimated at 650 miles and the fall is 4,000 ft. The Kansas City *Times* suggests that the project would be more practicable if it took in Kansas City, and it gives the superior railway distribution as a sound reason for this change of base.

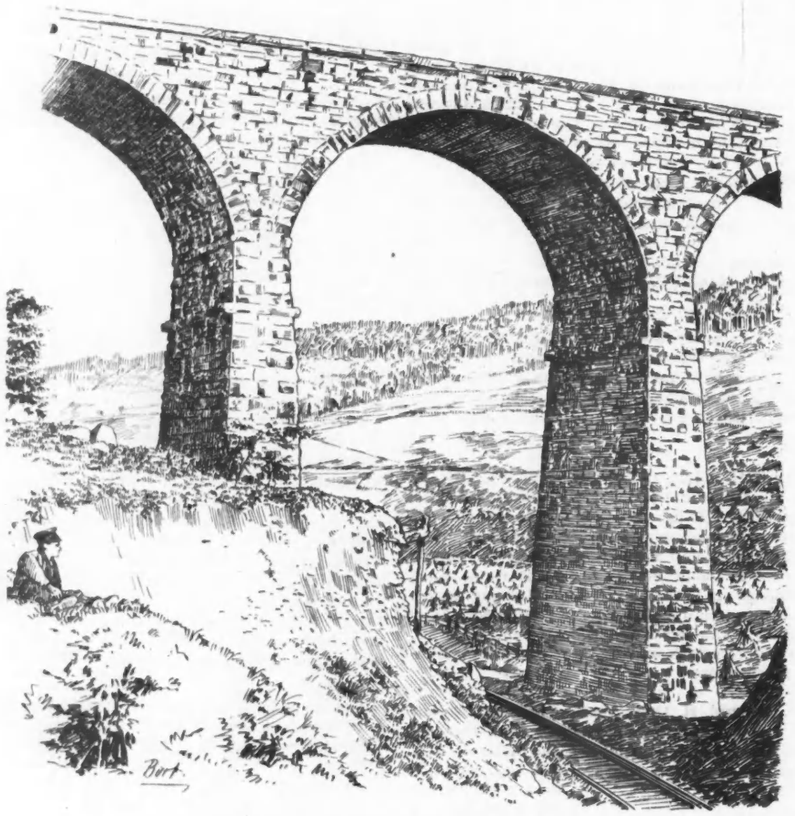
IN the report on the Mineral Resources of the United States for 1887, D. T. DAY, Chief of Division of Mining Statistics and Technology, puts the production of cement from natural rock for the last year at 6,692,744 barrels. He values this at 77½ cts. per barrel; or, $5,186,877 for the year's work.

The limit to the rapidity of filtration generally adopted by the London water companies is 2½ galls. per hour, or 540 galls. per 24 hours for each square yard of area of the filter bed. Water passed through well constructed beds at this rate or slower becomes bright and clear under ordinary circumstances.

The Starrucca Viaduct, on the N. Y., L. E. & W. Railway.

From a manuscript letter-book (with date of March 12, 1849,) of Mr. JULIUS W. ADAMS, Mem. Am. Soc. C. E., at that date Superintending Engineer of the Central Division N.Y., L.E. & W. Railway, and the designer of the viaduct in question, we are kindly permitted to give the following details of this interesting structure, and to present a bit of history which we fail to find otherwise in print.

The Starrucca viaduct, crossing a creek of that name, was commenced under a single contract with Messrs. Baird & Collins, Aug. 7, 1847; little work was done in that season beyond a search for suitable quarries and the founding of several of the piers. In the spring of 1848, the contractors who had undertaken the work at $8.50 per cu. yd. showed so little energy or appreciation of the magnitude of the task they had contracted to finish within one year, that the contract was taken from them, the company paying all expenses and purchasing what material had been prepared for the masonry, etc. Subsequently the work was divided into small contracts and done partially by day's work at the discretion of the Superintendent.



Starrucca Viaduct; from a Photograph.

It had been previously decided, that in place of steam or other machinery for hoisting purposes, it would be better to carry the stone to the work by rail track from the quarry onto a continuous scaffolding the length of the viaduct and lower it from the top. Consequently a heavy rail track had been laid during the winter, a distance of about 4 miles, to the main quarry. This track, the opening of the quarries and the concrete in the base of six piers, was all the work done on the bridge by the contractors. The railroad company assumed control at this point, and the structure was completed ready for the track on Nov. 10, 1848, and on December 9 a locomotive passed over it.

The text states that this short time alloted to the completion of the viaduct, had an important influence on its cost, as everything was forced; the quarries and the work were covered with men, and machinery and tools of all kinds were provided in excess, and up to the laying of the *last* stone everything was kept in its maximum working condition. A complete set of centers for the whole 17 arches was made, and scaffolding for the whole work previously erected to avoid any delay during the working season.

Mr. ADAMS says that up to that time no piece of work of the same character and magnitude had been executed in the same space of time, viz: only one season. He ascribes all the credit due for accomplishing this result to Mr. JAMES P. KIRKWOOD, who was the Superintendent in charge of the construction after the failure of the original contractors to comply with the requirements of their contract.

The foundation material was a coarse hard gravel, pervious to water. This was excavated to depths varying from 6 to 9 ft.; a bed of concrete 3 ft. in thickness was then put in, made up of broken stone and coarse gravel from the foundation pit. The stone used for the work was a light gray sandstone of fine texture, belonging to the lower members of the Catskills group, but partaking of the character (save that it is deficient in fossils) of the next inferior group, the Chemung, which graduates into the Catskills, and is found lower down the Susquehanna river.

As the country abounded in flat stone about 3 ins. in thickness, the original intention was to build the viaduct of rubble masonry, using the stone undressed and laid in full beds of cement mortar. But on opening the quarry it was found that blocks of 9 to 18-in. thickness could be obtained with generally flat beds, and the plan of masonry was changed. The beds of the stone as they came from the quarries were "pointed off" to a distance of 2 ft. from the face; the remainder of the block forming the heart of the work was left pretty rough but generally flat, without any dressing. None of these stones were "dimension stones" properly, save the coping; occasionally the piers were levelled up, but generally there was no regard paid to courses. In lack of a better term Mr. ADAMS classified this masonry as "dressed rubble rock-face."

The arches are of the same character, no regard being had to either the length or thickness of the arch stones, excepting that in all cases the arch stones go *through* the arch. Nor were the voussoirs or "ringstones" uniform save in the direction of the depth of the arch. The skewbacks were all cut to bed and bevel, but were not of uniform size save in one dimension, viz.: the minimum thickness. The whole of the work was left with a rock face.

DIMENSIONS.

Length of parapet	1,040 ft.
" " abutments, each	30 ft.
Concrete base	18 ft. 6 ins. × 40 ft. 3 ins. × 3 ft.
Foundation walls	17 ft. × 37 ft. 6 ins.
" " at top	13 ft. × 33 ft. 6 ins.
Piers at base	32 ft. 10 ins. × 11 ft. 4 ins.
" " top	7 ft. × 24 ft.
Batter of face	½ in. per foot.
" " head 1 in. per foot from top of foundation to a height of 14 ft.—thence.	
" to springing ¾ in. per foot. (This change was occasioned by the decision at this point to increase the width at track 2 ft.)	
Height of pier from top of foundation	65.67 ft.
Springing line below track	25.33 ft.
Grade above top of foundations	91 ft.
Width between coping in the clear	19 ft. 10 ins.
" " head-walls out to out	24 ft.

The head walls were built plumb, and the grade over the viaduct, as also the line of the springing of the arches, is at the rate of 60 ft. per mile.

QUANTITIES OF MASONRY.

Concrete foundations	1,069.89	cu. yds.
Foundation walls	1,513.00	"
Piers	9,446.85	"
Abutments	1,391.33	"
Arches	2,753.64	"
Backing	925.34	"
Side and head walls	1,840.87	"
Walls	391.67	"
Spandril walls (brick, 225,000)	476.89	"
Flagging on top spandrils	505.61	"
Side and cross walls of abutments	703.75	"
Coping	240.00	"
Total	21,259.03	"
Excavation in foundations	14,100	"
Backfilling piers and abuments	7,727	"
Total	21,827	"

The cutting and laying of the stone was let in several contracts under the direction of the Superintendent and will average as follows:—The stone was delivered to the cutters at the cutting yard, and to the stone-layers in the cars on the platform of the scaffolding. The contractors furnished the laborers in unloading and hoisting, and the railroad company provided the mortar and machinery, and delivered the stone on the ground at the main track. A side track ran along the viaduct at a height of 33 ft. from the ground, and another paralleled it at the level of the spring, or 66 ft. from the ground. From these points the stone was moved by common boom derricks. The contract prices were as follows:

	Per cu. yd.
Cutting piers and head walls, measuring 2 ft. 6 in. from the face into the wall	$2.50
Cutting voussoir.s	3.30
" coping	5.50
Laying piers, arches and abutments	1.75
" side walls and coping	1.50
" brick spandril walls	2.50

Hard-burned brick cost $6 per thousand, and salmon brick cost $2 per thousand.

SUMMARY OF COST OF STARRUCCA VIADUCT.

Foundations, including pumping and bailing	$ 0 ,823.58
Concrete	7,7 9.45
Quarrying, including tools and derricks	,,041.21
Railroad track, from the quarry exclusive of rails, the latter furnished by R. R. Co	18,247.65
Cars and wagons	7,473.94
Hauling stone	37,882.57
Cutting stone, including tools	35,021.37
Laying stone, including tools and derricks	42,038.67
Mortar, including mixing and delivering	41,469.64
Brick, brick-laying and hauling	5,147.17
Scaffolding and centers	35,403.57
Workshops, houses and shanties	4,995.29
Land and damage by quarry and track	1,930.87
Damage by accident and freshets	404.19
Miscellaneous and office expenses	9,694.43
Total	$335,203.60

The value of timber, etc., remaining on hand was estimated at $25,000, which would leave the cost of the work proper at $310,203; this would be something over $14 per cubic yard. If two seasons had been expended, and the work done by contract, Mr. ADAMS had little doubt but that the original estimate of $200,000 would have covered the cost of the viaduct.

The centers were all struck at about the same time and immediately after the closing of the arches. The settlement on striking was 0.02 ft.

The mortar used was equal parts of Rosendale cement in powder, and unslacked lime; or,

Rosendale cement and lime	1 part.
Sand	1½ to 2 parts.

The foundation concrete was made up as follows:

Rosendale cement	1 part.
Dry sand	1½ parts.
Stone and gravel	3½ "

The arches were segments of a circle with 51 ft. span. The detail design of arches and piers and the general design of the finished structure are shown in the accompanying plans.

This Starrucca viaduct is still used as the main line of the Erie railroad; a double track having been laid by the present engineer of structures, Mr. C. W. BUCHHOLZ, where formerly the line was operated by a gauntleted track. It has practically cost nothing for repairs in these 40 years. Another interesting item about it is, that the original estimates showed that an earth embankment, with a stone arch over the Starrucca creek, would have exceeded the estimated cost of this viaduct, the region being devoid of good borrow-pits.

From Preliminary to Track—Points in Railroad Construction for Young Assistant Engineers.

BY MILNOR P. PARET, C. E.

(*Concluded from page* 147)

Satisfactory plans for masonry of any sort cannot be made without drawing and consulting situation plans; such plans consist of the center line, the stream or road in its correct relative position, one or two foot contours and any other topography. In connection with such a plan there should be a profile of the road or stream, elevation of extreme high water, cross-section of stream at flood stage and any other notes or information which may seem of service, such as notes of adjacent bridges or openings. Any arch or open bridge can best be staked out and at the same time referenced from the center line of the bridge or the line one-half way between the abutments. Set a plug at the intersection of the center line of the railroad and the center line of the bridge, turn the proper angle, on the latter line, set plugs on the line of faces of arch and end of wings. The transit can be set over these plugs, the proper angle turned, and distances measured out to neat points. To guard against the possible loss of these plugs, set two reference points each way and some distance from the line. Most of the masonry will be at right angles to the line, and to set excavation stakes, which should be from a foot to 3 ft. outside of the foundation lines, a large T square, say with 10 ft. top and 15 ft. leg, is very useful. Elevations of the ground surface should be taken at the corners and other breaks within limits of the pits, so that the amount of excavation can be figured. Should it only be desired to go below frost line with the foundation, the bottom of excavation can be noted at once, and the cut marked on the stakes.

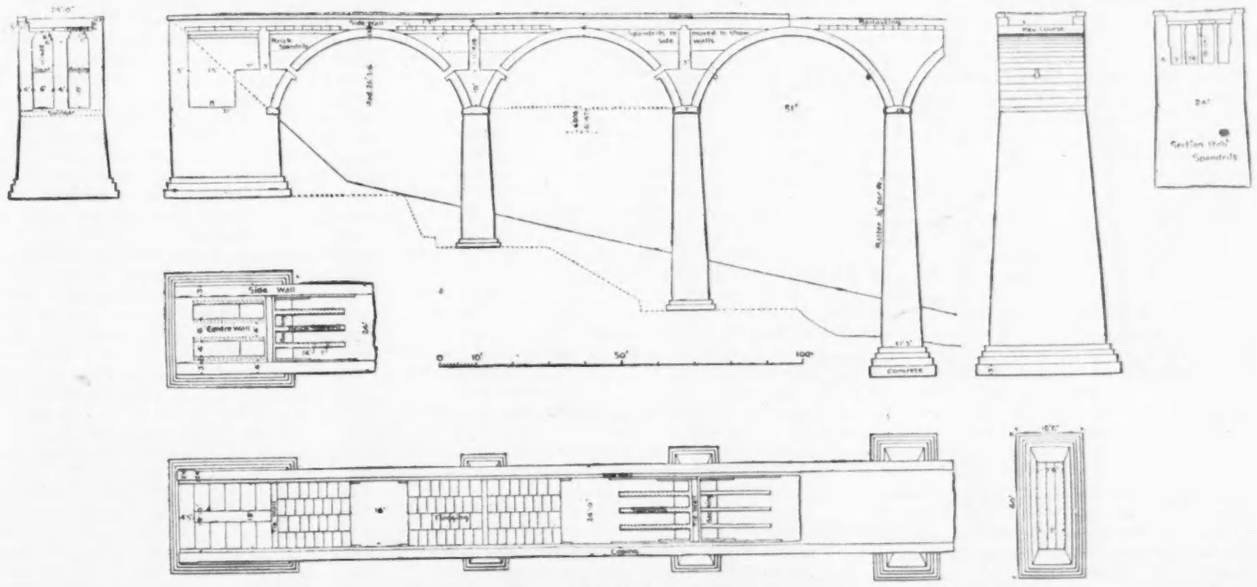
A note book, called "Masonry Book" should be kept, and nothing but masonry notes kept in it. Let us suppose an example to illustrate a good method of keeping such a book. A small plan is drawn, showing both center lines and the neat dimensions at top of foundation, on this plan also show the reference lines and location of reference points; and distance from reference lines over to neat corners. Note on this same page the span at springing line if an arch, or span under bridge seat, if an open bridge; the elevation of top of foundation, springing line or bridge seat, also description and elevation of nearest B. M., and note that foundation is so much wider all round than neat work. On another page draw a similar plan, showing simply the elevations of the ground surface; on this page also note the elevation of bottom of foundation, the kind and depth of material passed through and kind of foundation. A third page can be taken up with notes, such as dates of staking out, excavation started, foundation started, neat points given, centers up, bridge's seat set, finished, and other points which may come up, such as delays, cause of them, etc.

When the grading work first begins, insist upon it that the contractor sends men over the line to drive tall guard stakes at each slope stake; when slope stakes are lost they are sure to be the ones you want to use when taking monthly estimates. Such monthly estimates are taken from the 20th to 25th of each month, depending, of course, upon when the assistant engineer must have his reports in at the head office.

It is *not* good practice to walk over 5 or 10 miles of line in half a day, and with the aid of a tape and note book get up the bulk of the monthly estimate, there should be a system used on all work, and as the greater part of the duties of the assistant engineer are in direct relation to monthly and final estimates, he should have if possible a better system for this work than for any other. Have a separate and distinct field book for the notes and do no calculation for the volume in the field. Take cross-sections wherever a cut is opened and at the same plusses as were used in taking the original cross-sections. The cross-section book should always be taken in the field for the purpose of reference. The classification should be taken at the same time and by cross-sections, in fact, as parts of the whole. The line of demarcation between earth and loose rock, loose rock and solid, is generally plainly discernible when the cut is fresh, though it is often necessary for the assistant engineer to estimate such lines according to the difficulties met with in plowing or drilling, etc. Take also elevations on the center line over the fills, and measure up borrow pits and other small pieces of work outside the direct line grading, also by cross-sections. Note the state of the various pieces of masonry, etc. Of course no great accuracy is supposed to be used in taking the cross-sections of a monthly estimate; centers can generally be set by measuring in from a slope stake; in case the cut is too deep to do this handily, the center line should be run in with the transit. Tell the pit foreman how they are for grade, center and width, as the estimate is taken; otherwise they will want such information in a few days, when the level will have to be sent out for this purpose.

The grading estimate sheets should have about the same form as those in the preliminary estimate. It will not generally be necessary to work out the yardage in the fill, but it is well to do it occasionally for your own information. The whole cut is first calculated without regard to classification then the loose rock and the solid separately. Have an office book for masonry excavation and another for miscellaneous excavation; each book should be illustrated by sketches of plans or cross-sections etc., whenever necessary. Still another office book for masonry calculations is one in which all the final figuring for complete masonry should be done in ink; illustrate this book also with plans, cross-sections, etc., of each piece of masonry. All these books should be kept in a manner which will be intelligible not only to yourself but to anyone. Of course no notes are entered in these books until they have been checked, and do not forget that initials should show who made and who checked not only each estimate sheet but the work on each piece of miscellaneous excavation, or piece of masonry. The calculations of masonry for monthly estimates need not be preserved unless the piece for calculation is partly finished, say all the foundation, or in an arch, the bench walls to springing line. The masonry sheet of the estimate papers need not bear any detail, it will soon resolve itself into a series of references to certain pages in the masonry book;

Starrucca Viaduct; General Elevation.



Starrucca Viaduct; Details.

the same is the case with miscellaneous and masonry excavations, which should come on the estimate sheets according to station and be simple references to such estimate books.

It is well to have a printed form for the summary; if not, make one yourself and use the same form always for each section. The bill or voucher on which the contractor is paid will have a certain form, and is generally filled out and certified to by the Asst. Engineer.

Have as little extra work as possible, and whenever possible get written permission for it from the Chief Engineer. Nine-tenths of your unpleasantness with contractors, and possibly with your superiors, will arise from extra work. And not a little diplomacy must be displayed in getting it done reasonably and well. All extra work should be paid for by bill or voucher the month it is finished; it is not contract work and consequently should not go on the same bill or voucher with the egular estimate.

Keep a progress profile and turn it in every month with your estimate and report. Such a profile contains, in addition to all the information of the regular profile, notes in the proper place of the progress made to date of each piece of masonry or outside work, and the progress of the grading shown as follows: Plot the elevations on the center taken at estimate time, and color with one of a prearranged set of colors, the space between the line joining these elevations and the original ground surface, or the grade line and the last color; thus each month shows the existing ground surface and roughly the amount of cut taken out and fill made. But remember that this profile only shows the center line, consequently you may need side notes to the effect that fill or cut is narrow, or cut is for double track. On the detailed estimate sheets it is well to show in pencil for the sake of comparison the yardage of each cut or piece of masonry according to both the cross-section estimate and the preceding monthly estimate.

Be particular to have some system about not only your own accounts but also your returns to the Chief Engineer; it will be appreciated, as even a poor system is better than none. As soon as a cut is finished and trimmed up it should be measured up and calculated for "final," and the same rule applies to masonry or other work; by so doing, the work for the final estimate on any section is nearly all completed by the time the section is finished. The great bulk of the time of the Asst. Engineer and his party is given, of course, to routine out door work and supervision; leave office work for rainy days or night work.

The Asst. Engineer should discountenance quite severely the indiscriminate affording of information to outsiders by members of his party, and he will do well to guard himself against the same possibility. The report—"the engineers on the work say,"—is often apt to cause no little annoyance in quarters to which it is extremely undesirable that such annoyance should find its way. To this end no little diplomacy is often required in such matters as quieting annoying claimants, avoiding difficulties with the contractors, the obtaining of concessions from property owners, county commissioners or road supervisors; and any such desired end should be obtained by tact and not by misrepresentation. There may arise occasions in a righteous cause, when it is desirable to close temporarily some one's eye, in which case follow the judgment of the Chief Engineer, and not your own.

Unless you have a man whom you can spare to devote his whole time to it, the writer inclines to the opinion that any attempt to take force account (except for extra work) is time wasted. In watching and inspecting masonry do not pay all your attention to the neat work; what is wanted chiefly is substantial work, and the backing and making up is most apt to be slighted by the masons. Subfoundations of concrete are always good, but be careful how you use ordinary cement in pits which are at all wet. Footings for trestle bents are often and properly made of concrete carried below frost line and capped with a 6 or 10-in. coping. Put 6 or 8 ins. of concrete in the trench dug for drain pipe. In laying drain pipe or building box culverts, put them 6 or 8 ins. lower than the lowest ground to be drained. The writer gives preference to the use of concrete over grouting in making up any kind of masonry. Concrete is cheap and the contractor will generally be glad to use it for such purpose; you may not be able to give the constant attention to the masonry which you would wish, but you can at least feel that concrete filling is not half so apt to be slighted as grouting. Indifferent grouting is about as good as none.

An inspector of masonry is not necessary unless you have tunnel arching or some large piece of masonry in which there are many thousand yards; there is not the opportunity to slight work on small pieces of masonry that there is where the size of abutments or piers allows the laying of a hundred yards in a small space of time. Of course some grouting, in the case of close joints will have to be done. In brick arches the masons should lay to a line as carefully as if they were carrying up the wall of a house. Do not force in a heading course, let it come where it will naturally; but the same heading course should extend unbroken from face to face of the arch; always wet the bricks. If ringstones are used in the face, and the rest of the arch is made of brick, see that the thickness of the ring and keystone are calculated for so many courses of brick.

Too much care and oversight can not be given to foundations of all kinds. Better to be charged with using a few yards of masonry more than was estimated for, than cause the expense of rebuilding an abutment because it settled and went to pieces. You will certainly get the discredit of the latter result, even if otherwise the only credit be that of exceeding the estimate.

As before mentioned, great care should be used in filling back of and over all masonry. Such fills should be made in layers of not more than 2 ft. in thickness, and well hauled over or even packed and tramped down for a distance back from the masonry of what would otherwise be about the natural slope of the ground.

It is well (as a precautionary measure) not to *draw* an arch center until it has its permanent load, or at least a uniform one covering the limits of natural earth slope on each side. The best possible support for centers of arches is made by projecting occasional headers in the course below the springing line course and laying on them the stringers from which are blocked up the ribs. The projecting stones can be cut off after centers are drawn.

The Asst. Engineer should not forget that it is a large part of his duty, to be of every assistance he can to the contractors, with a view to expedite the work. If this works to the advantage of the contractor, it also does to that of the railroad company in even a greater degree. The sooner the road can be operated, the sooner will there be some return on the investment, and, (consoling thought) so much the sooner will they be ready to dispense with the expense of your services.

Two diaries may well be kept on construction work, by separate men, each being held responsible for its care and completeness; one to be a record of the day's doings of the corps, the weather, etc., and the other a record of the actual construction, such as a note each day of what gangs are at work; what doing and where; when a certain piece of grading, other excavation, or masonry is begun, temporarily stopped, finished, etc. It is often extremely desirable to know months afterward just what day such a piece of work was done.

Keep the cuts full width and the fills wide and high, you may be surprised after a heavy rain of a couple of days to find some of the fills all gone to pieces. Center lines and grade should be given occasionally on both cut and fill for the guidance of the pit foreman. As soon as the grading is nearly finished, the corps should go over the center line and make such slight corrections as are necessary to make an exact alignment. The best location work cannot be as correct as that done when the line is graded. Before this is done, however, the right of way should be staked out from the original location, as it was bought from that. This work should be done carefully, though of course it is not essential that it should check out to the tenth, except in case of valuable city or town properties.

So soon as any portion of the revised and permanent center line is put in, it should be very carefully and intelligibly referenced for permanent record. Centers for iron work on bridge abutments and piers should be set from the revised center line. If on a tangent, obtain if possible a sight from P. C. to P. T.; if on a curve, see that such a running of the curve checks up at the P. T. Stones should mark the P. Cs. and P. Ts. of the final alignment, it is not a very great expense, and in many cases saves a future generation a vast deal of annoyance and expense. When there are grade crossings of public and private roads, get them in good condition, well drained and metaled, as soon as possible, and keep them so, particularly the public road; the suffering public is apt to be antagonistic to grinding monopolies. Should a milk or hay wagon get fast in the mud, or a new Victoria get slightly soiled at a grade crossing, the same suffering public are sure to carry their complaints to headquarters, and as a result make it unpleasant for the Assistant Engineers.

In making berme ditches, put them as far from the slope as possible, make them ample, and be sure they are drains as well as ditches. Berme ditches should be dug along fills also whenever it is necessary to drain standing water to the nearest opening under the track. Do not open the side ditches until all the work on or hauling through the cut is finished; after the side ditches are dug and sub-ballast on, stop all hauling or driving over grade by blocking off the line by temporary fences.

Sub-ballast will cost from 80 cts. to $1.50 per yd., depending on the cost of stone to contractor; when over $1.50 in place it is cheaper to bring it on by train service with track laid on the dirt, of course if ballast is cheap, as in case of good gravel pit convenient to line, the train service is much cheaper.

Generally one of the last pieces of work to be done is the erection of the telegraph line, it is almost always contract work and for the more economic delivery of material it is better done after track is laid, unless there be other reasons for having the wire through before. It is but a few days work and the duties of the Assistant Engineer amount to little more than seeing to the delivery of material, that the line keeps on the right of way, that high poles are used at road crossings, and that the erection is substantial, etc. Telegraph line (single wire), will cost $175 to $250 per mile.

The right of way or at least a portion of it, will have to be fenced. The cost of post and rail fence, chestnut 4 or 5 rails, will run from 75 cents to $2 a panel. A wire fence, cedar posts, 5 or 6 wires, will cost from 5 to 10 cents a running foot.

Track may be laid over your division either by contract, or if the line be a short extension of some existing line, by direct labor of men and materials taken from the main line. The duties of the Assistant Engineer will vary according to each case. If by contract, he becomes practically a supervising engineer to see that the contract is fulfilled, that the line and surface is good, tamping up what it ought to be, to look after elevation on curves, spacing of joints, ties, leads of switches, turnouts, crossovers, signal and switch stands, that material is not wasted or damaged, to keep trackmen in center and grade stakes, check the amount of material received and used by the contractor, including ballast, and hand in estimates of work done as on grading.

Should the track be laid by labor and force account and not by contract, the Assistant Engineer should, in addition to the above, keep the time of train crews and trackmen, account of tools, cars, trucks, etc., in use, and much more closely oversee the tracklaying and distribution of ballast, etc. Unless there be occasion for great rush, track can be laid best and cheapest by putting in at first the full number of ties. To jack up track dig out ballast, slip ties in, then possibly retamp ties is considerably more costly than to lay them at first. The ties should be lined and spaced carefully before the rail is laid, the best ties should be used for joints and these can be placed with some accuracy for a couple of rail lengths ahead. Throwing track around and relining is always expensive work. If the track must be laid off the line for any reason, see that joints are well open or close as the case may call for, it is bad to have to cut a rail when track is thrown to true center. Keep trucks and tools in repair and do not leave them or material of any kind scattered along the line.

If there is quite a piece of track to be laid and there is not much liability to interruption, such as running out of material or the men being called off on other duty; it is best to organize the men as thoroughly as possible, have certain men for certain work and no other, such a man to see that material is brought forward as wanted, a certain gang to unload from cars and load on trucks, another gang to

unload from trucks and space the ties, others on rails, others to spike up and make up joints, etc. Good material and force accounts should be kept so that the Assistant Engineer will be able to figure up closely just what each sort of work costs per unit. An estimate for a mile of track is easily made; the market price of iron, steel, ties, etc., is pretty constant, and the quantities required easily calculated.

Track laying will cost from $600 to $900 per mile according to final shape of track.

Railroad spikes 5½ ins. long weigh 200 lbs. to a keg in which there are about 375. Splice bolts, keg of 200 lbs., about 225 to keg. Verona nut locks 1,000 to the box. Most railroads have different methods of laying turnouts, crossovers, etc., but the following thumb rules are often convenient:

Lead of switch = 2 (gauge × frog number)

Distance between frogs in crossover =

$$\frac{\text{Distance between tracks} - \text{the Gauge}}{\text{Frog number.}}$$

The remarks on track may well be closed with the remembrance that track in good line and surface, cuts and banks uniform and full width, clear ditches and roadbed, etc., always makes a good impression on the officers of the company when the "special" comes over on "inspection."

There may be construction of small stations, turntables, water tanks, etc., to oversee; but plans and instructions for such structures are generally quite complete as received from the Chief Engineer.

The work of the Assistant Engineer is not complete until he has put on all the masonry plans, the depth of foundation, nature of material passed through and founded on, the number of cubic yards of excavation and masonry, and further made up in neat form, a permanent record book giving final alignment and grades, record of R. Ps and P. Ms, pluses of center and size of openings, points of switches, length of sidings, etc.

In conclusion a few words with regard to dealings with contractors. It is their business to make all they can out of their work; it is that of the Assistant Engineer to see that the contractor gets justice, that is, neither more nor less than he is rightly entitled to. The road is to be built economically of course, but not by putting unjust expense on the contractor.

Know the peculiarities of the men you deal with as soon as possible, a method which would obtain with one, might utterly fail with another. Though your relations should be amicable, be careful how you accept favors of the slightest form.

Trifles light as air are blown a long distance and gather moment and mass as they fly.

Civil Engineering is by all means a noble profession, for which reason, if not for your own sake and respect, you should help keep it clean.

A New Nut-Lock.

The nut-lock illustrated herewith is something new in an extensively worked field of invention; and as the cost is set down at one cent for two bolts, it should certainly be accorded the merit of simplicity and cheapness. It has been used, we understand, for rail-joints on different roads under heavy traffic for several years without a case of failure.

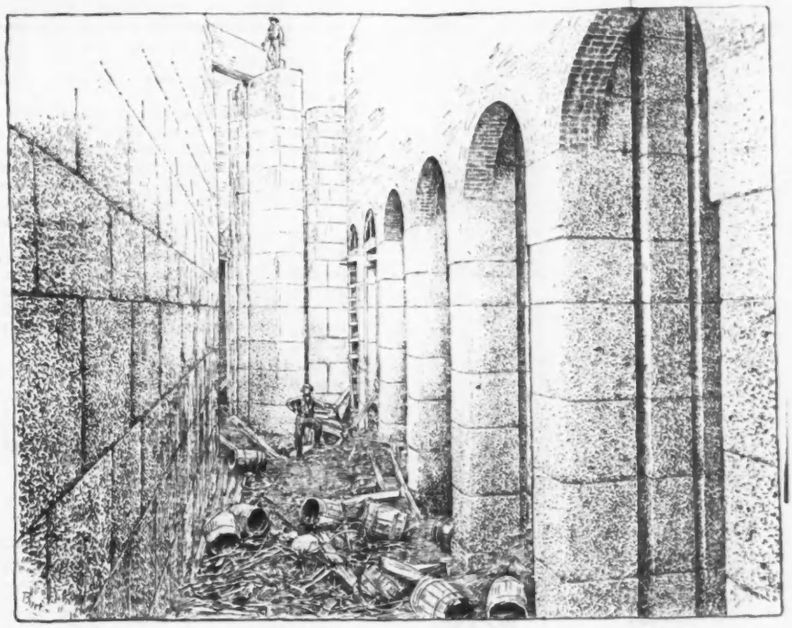
The lock consists simply of two washers, or tongues *A* and *B*, cut out of one-twelfth inch sheet-iron. Each of these has in it a hole near one end for the passage of the bolt; and the other, or free end, abuts against the face of the nut on the other bolt, thus preventing it from turning. The free end of the washer *A*, as show in the figure, is T-shaped and passes up through a rectangular slot in the other washer *B*.

In order to turn the nuts when occasion arrives to remove them, the free ends of the washers are bent up out of the way by means of a crow-bar or pick-end, as shown. A blow of a hammer will bring them back to place and lock the nuts again. Larger washers of the same design are made for use with three bolts each. The inventor is Mr. J. F. DILL, of Ridgway, Pa., to whom interested parties are referred for further information.

ENGLISH papers state that Germany has 25,000,000 marks, or about $6,250,000 invested in the manufacture of explosives. The annual output is about 120,000 cwt. and 1,200 to 1,500 men are employed.

Convent Avenue Gate House — New Croton Aqueduct.

All the water to come through the new aqueduct, except a small quantity to be pumped into the high service tower located at the western end of High Bridge, and such as will be necessary to supply the district passed through south of the Harlem, will be led to the gate house at Convent Ave. and 135th St. Here the supply will be divided: four 4 ft. mains will lead the largest portion to the new reservoir in Central Park, from whence it will pass through the present gate house to the distributing mains; four other pipes of the same size will connect with the general system at points along the line of the first four; four other pipes will join the pipes of the present aqueduct at 10th Ave. and 135th St.

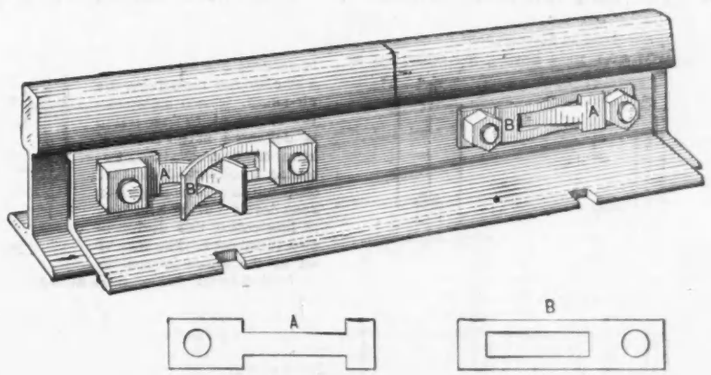


Convent Avenue Gate House: New Croton Aqueduct.

The gate house measures outside, 130 × 60 ft., and at its northeastern corner is provided with a tower through which the water enters by way of a vertical shaft. The water enters the main chamber through two arched passages, in the faces of which are cut vertical grooves for the reception of stop-planks and screws, by means of which the supply can be entirely cut off. The main chamber, shown in the accompanying illustration, which is from a photograph looking toward the northeast, or entrance, is 74 ft. in length by 12 in width. Leading from this chamber are eight passages, each 6½ ft. wide by 9 long, the dividing walls being 2¼ ft. thick. Each passage is furnished with grooves to receive stop-planks, or screws, in the end next the main chamber. From the opposite ends of the passages begin the cast-iron mains which are provided with valves to control the outflow and with sliding gates which serve to shut off the water in case the valves need attention. The valves are in chambers 7 ft. wide and 12 long, united by a circular passage.

Extending across the building at the western end of the main chamber is a wall which forms the inner side of a receiving chamber, to which the water from the old aqueduct will be admitted, and from which it will be distributed through the four pipes above mentioned. This wall is provided with openings by which the chambers can be connected. This arrangement, which was not contemplated in the original designs, makes this gate house the principal distributing point for the whole supply.

All the gates will be operated from the main floor through suitable connecting rods. The water chambers and gateways are faced with granite, while the valve chambers and vertical portion of the inlet are of brick. The exterior of the building is of contrasting shades of granite, trimmed with hammer-dressed light granite. An elevation, plan and section of this gate house was published in our issue of Oct. 30, 1886.



The Dill Nut-Lock.

The building is being erected by R. H. MALONE & SONS. The contract price is $157,000 for the building alone. The estimated cost of the structure completed is $250,000.

DURING 1887, the coal output of Great Britain and Ireland amounted to 162,000,000 tons; an increase of over 4,000,000 tons on 1886. Of this total only 23,000,000 tons were exported. The total output from English mines of all descriptions in 1887 was 173,000,000 tons: and 568,000 people, including 5,700 women, were engaged in this work. During the year 1,051 lives were lost in mining operations, amounting to one killed in each 540 persons at work.

Connecting Rods.*

The form of connecting rods described by Mr. MATTES has been used at the Lackawanna shops at Scranton, Pa. It differs from the ordinary marine rod, first, in having jaws of sufficient length to hold both boxes; second, in having a cap which hooks

Fig. 1.

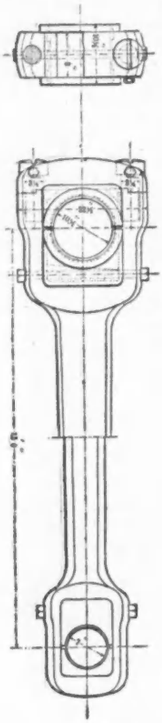


Fig. 2.

over projections on the jaws. A combination of hooks, box flanges and bolts thus holds the cap in position; on account of the long jaws and counterbore of the cap, the office of the bolt is merely to clamp the parts together, and no particular accuracy need be observed in fitting them.

As compared with rods having the outer box secured by a transverse bolt passing through eyes in the jaws, the following advantages are claimed:

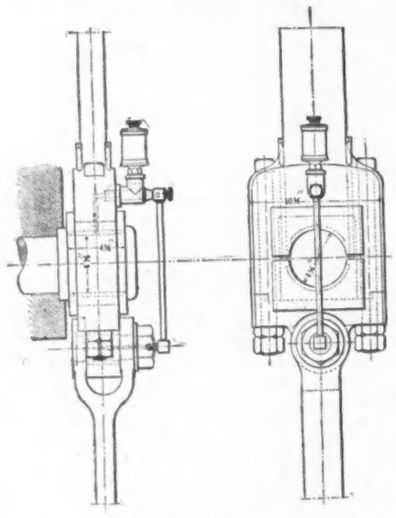


Fig. 3.

The flat parallel sides of the head facilitate the operations of forging and finishing; the tensile stresses are taken by bolts, in which the required strength can be easily and certainly secured, instead of by eyes of uncertain condition, cut out of a large forging; an unsightly swelling at the end of the rod is avoided, and the weight sensibly reduced. Rods with the transverse bolt are frequently seen with flat-sided heads, but the result is achieved by a disregard of nicety in proportioning which is allowable only in small sizes. For the main rods of locomotives having two pairs of drivers, the transverse bolt is most convenient, but this is a special case, and the precedent should not be blindly followed. As compared with the old strap-rod we find the new form cheaper to fit up and better in use. As compared with the solid-head rod, the open end is a great convenience, except on crosshead ends where the pins are removable: the jaws hold the boxes with equal rigidity, permit the use of full flanges on both boxes, and do away with loose collars on the crank pins.

Fig. 1 shows a plain form of the new rod. This was designed for use in pairs, connecting the ends of a crosshead with a pair of fly wheels. In such a case it is usually safer to take up the wear by liners, rather than by wedges or cotters. The opposing screws pass loosely through the caps, and are threaded in the boxes. We have discovered no advantage in the use of these screws for low speeds, and have had no opportunity to test them otherwise. For small rods we prefer the plain, straight caps shown in this figure. They are convenient for fitting, and the distribution of metal is better than appears at first sight. The bolts have round heads slightly countersunk, and are kept from turning by a spline.

Fig. 2 is the rod used in a pair of horizontal, coupled, blowing engines, with 52×60 in. steam cylinders. Here a wedge was almost a necessity, and to clear the adjusting screws, tap bolts, instead of through bolts, were adopted to secure the caps. As before, the holes are loosely drilled through the caps; the holes in the rod being threaded by special taps. The bolts are steel 3¼ ins. in diameter, and are chased 5 threads to the inch. All parts, excepting the boxes, are hammered steel. The wedges are full width, and threaded for the adjusting-bolts, which are in tension. The boxes are "Eureka" steel, cast, fully faced with babbitt.

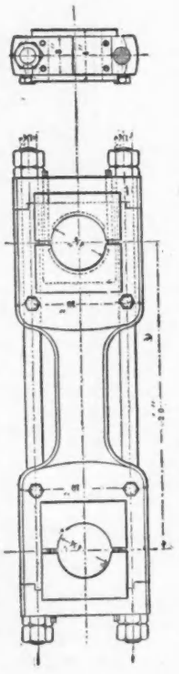


Fig. 4.

In Fig. 3, is shown the crank end of one of a pair, dropped from the overhead beam of a compound engine. The cap is formed with an eye, bushed with hardened steel, to which is secured the forked end of a smaller rod for driving the air-pump. At each midstroke the thrust of the air-pump is delivered at an angle of about 45° to the cap; thus imposing a somewhat unusual test, but no loosening has been developed. The method of lubricating this design is also illustrated. The flow of oil to the lower journal is controlled by the milled head at the upper end of the long tube.

In Fig. 4, we have one of a pair of short links, connecting the journals of a beam with a crosshead below. The construction is similar to Fig. 1, except that the bolts pass through both ends, and are kept from slipping during erection, or at any time when the caps have to be loosened, by the small set-screws shown on the sides of the heads.

The method of constructing all these rods is to first forge the head solid; then holes for the interior angles are drilled and a block slotted out, forming the jaws. This operation should be completed before the projections on the jaws are turned to a finish, particularly in large sizes, as it is likely to cause a slight springing. Finally the boxes may be fitted and the outer one used as a center for finishing the projections.

* Abstract of a paper by W. F. MATTES, presented at the Seventeenth Meeting of the Am. Soc. Mech. Engineers.

THE late report of the condition of the Channel Tunnel Works (England) to the Board of Trade shows that the experimental tunnel is 2 miles long, is if anything drier than at the last report, and that the boring machine is still in position and periodically worked to keep it in good condition, though only 8 ins. in length have been cut in the chalk since December, 1886. The pumps are worked twice a week for about 3 hours, as only 440 galls. of water collect in 24 hours.

Strength of Ropes.

The quality of workmanship, strength, extensibility and elasticity of round and flat ropes of hemp and aloe, and of iron and steel wire, have been experimentally investigated by Mr. A. DUBOUL, and the results of his experiments published in the *Bulletin de la Société d'Encouragement des Arts*, Paris. In his experiments Mr. DUBOUL used a horizontal hydraulic press and a weighing apparatus consisting of a steelyard and sliding weight, by which tensions of from 1 to 130,000 lbs. could be recorded. For higher pressures a gauge on the body of the press was used. Specimens were fastened by winding each end on a grooved pulley of special construction. The usual length of specimens for testing was 13 ft.

The results of all the tests gave for the average tensile strengths of ropes the following:

	Lbs. per square inch.
White hemp	10,500 to 11,200
Tarred hemp	7,700 to 8,400
White manilla	9,800 to 10,600
White aloes	5,600 to 7,000
Flat, tarred hemp or manilla	7,800 to 8,400

A factor of safety of 4, or even 3 in some cases is considered safe for ropes.

A rope of unannealed wire has an ultimate tensile strength of about 55,000 lbs. per sq. in. of section of metal; when annealed the ultimate strength is reduced to about 45,000 lbs., but the elongation is nearly doubled, being 12 to 15 per cent. in annealed wire. The best wire ropes for mining purposes have a much higher tensile strength. Another writer on the same subject says that the tensile strength of a wet rope is only one-third that of the same rope when dry, and that a rope saturated with soap or grease is still weaker.

Early Experiments on Train Resistance.

A recent editorial in *The Engineer* gives the following very interesting, but somewhat too sweeping summary of some early and now little known experiments on train resistance, dealing with questions which are even now about as obscure as they were then. We have used the article, with some of the conclusions of which we can by no means agree, as the text for an editorial in another column.

A recent article on the speed of locomotives has elicited several letters from correspondents, all suggesting the fitting of a wedge-shaped appurtenance to the leading end of the engine as a means of reducing the resistance of the air to the motion of the train. That there is such a direct resistance caused by the pressure of the air against the front of the smoke-box, etc., everyone who has stood on the front buffer beam while an engine was running at speed can safely assert as the result of his own personal experience. That it is possible in any way to eliminate or reduce it by altering the form of the leading end of the engine is, however, quite another matter, which we propose to consider here. Of recent experiments we shall say nothing; we shall confine our attention to investigations made in the infancy of railways, and concerning which nothing is now heard, because the present generation has forgotten all about them. But it is none the less certain that for accuracy and trustworthiness they have never been excelled, and they consequently possess an immortal value which cannot be lost.

The first investigation to which we refer was carried out by NICHOLAS WOOD, and full particulars of it will be found in his "Practical Treatise on Railroads", second edition, 1832. His experiments were intended to ascertain the rolling resistance of vehicles running on railways, and the axle friction of the same vehicles. The details of his experiments were ingenious, and calculated to meet all the conditions of practical railway work. We cannot attempt to describe these experiments in detail—we can only give the general results, which are that the resistance caused by rolling does not greatly exceed the one-thousandth part of the load, and that it is constant at all speeds and for all loads. It must be clearly understood that this statement has nothing whatever to do with the resistance caused by the deflection of the rails under the tread of the wheels; and it may be worth while to digress here for a moment to say that WOOD carried out experiments on this resistance also, which go to show that its amount varies with the stiffness of the rail, and is therefore, in no wise or way a constant quantity. On a good road, however, it cannot be a considerable quantity, and it is probably less as the speed becomes higher, because, speaking roughly, the rail has less time to bend under the tread of the wheels. We may set down rolling resistance as about 2.5 lbs. per ton.

Turning now to axle friction, we find that this also is very small in amount, and it is curious to note that WOOD obtained, more than 50 years ago, results practically

identical with those arrived at during the friction experiments carried out by Mr. TOWER for the Institution of Mechanical Engineers. That is to say, he ascertained that there was an enormous difference between the frictional resistance of a bearing flooded with oil, and one well lubricated only. Dealing once more with results, it appears that the frictional resistance of railway axles is about $\frac{1}{60}$th of the insistent weight when the surface speed of the journal is the same as the progressive speed of the carriage. The actual retarding effect will, of course, be less in the ratio of the diameter of the journal to that of the wheel. We may sum up by saying that according to this most elaborate, extended, and ingenious investigation, the combined rolling and axle resistances to a train amount to about $\frac{1}{200}$th part of the load.

It is clear from what we have said that the great augmentation of resistance met with in hauling trains as the speed increases is not due to either the rolling of the wheels on the rails or to the friction of the journals. It is mainly due to the air, and this truth was first demonstrated by Dr. LARDNER by a series of very costly and elaborate experiments carried out by himself in connection with Mr. EDWARD WOODS, recently President of the Institution of Civil Engineers, and Mr. HARDMAN EARLE, a director of the Liverpool & Manchester Railway, full details of which will be found in the published proceedings of the British Association for 1838 and 1841.

Until these experiments were carried out it was assumed that the resistance of a train was constant for all speeds, and amounted to about 9 lbs. per ton. LARDNER carried out a number of experiments to ascertain the amount of rolling and journal resistance, and found that at the most it did not exceed 5 lbs. per ton, and the result was confirmed by PAMBOUR'S investigations. The result is quite consistent with WOOD'S already noticed, because it includes the losses caused by deflection of the rails, bad joints, flanges, etc., which were not admitted into WOOD'S results. At the time of which we speak, there was a hot controversy as to the value of compensating gradients, it being assumed by some that it was possible so to lay out a railway, that no power whatever would be required to run down an incline, while the power required to climb a gradient would be double that needed on a level. Under these conditions the line would be worked for the same cost of engine power as though it were a dead level. As the resistance was assumed to be 9 lbs. per ton, it is clear that a "compensating" line, as it was called, must have gradients which did not exceed 9 in 2,240, or approximately 1 in 250. This permitted very considerable latitude to the engineer, and the thing was hotly opposed by another party, who asserted that a line with inclines of 1 in 250 could not be worked as cheaply as one on a level. It was held by the advocates of the system that if a train was put on any incline steeper than 1 in 250, it would continually run faster and faster till it got to the bottom. There was no use, LARDNER saw, in theorizing on this. What was wanted was not theory, of which indeed there was a superabundance, several competent mathematicians proving incontestably on paper that it must be so.

LARDNER, WOODS, and EARLE had placed at their disposal several inclines of different steepness. These were carefully staked out into 100 yd. lengths, the trains were brought up at speed to the tops of the inclines by locomotives pushing them; then they were left to themselves and permitted to run down. Two observers with stop watches took the times at which the stakes were passed, and it was quickly found that instead of the train running faster and faster as it proceeded down hill, there was a speed proper to each incline, and this once attained did not vary. Thus on an incline of 1 in 90 a train started from the summit at 40 miles an hour, gradually went slower and slower until its speed was diminished to 31 miles an hour; at this rate the train descended to the bottom of the incline at a speed accurately uniform. These results settled the 9 lb. per ton theory once for all. As the experiments proceeded curious and unexpected results were obtained. Thus it was found that a train of lowsided wagons loaded with bar-iron ran down faster than a train of passenger coaches. A heavy train ran quicker than a light one. As the road resistance was constant, it was clear that some other influence was at work. This was the resistance of the air. To diminish it a wooden prow or taper wedge was affixed to the leading end of a train. This made not the slightest difference in the speed. Then, reasoning by analogy that the shape of the stern of a ship has a great effect on her speed, the wedge was fitted to the last carriage. Again the result was *nil*. It made no difference whether the prow was used or not. To make certainty doubly certain, a front was constructed of boards projecting 2 ft. all round the end of the leading carriage. This also was found to have no effect whatever; it in no way retarded the train. "In fine", writes LARDNER, "the train offered precisely the same resistance whether moved with the flat end on the foremost carriage, or with the pointed wedge, or with the enlarged flat frontage last mentioned". More than one of our correspondents have suggested that, the space between railway carriages being open, the resistance of the air is greater than it would be if the train were continuous. LARDNER was told the same thing, so he had the spaces in the experimental train made up with canvas, so that the whole train resembled a continuous flexible coach, but the result was unaffected; filling up the spaces made no manner of difference. "All these results", says LARDNER, "led me to infer that the amount of the resistance depended on the volume of air displaced by the train, and that consequently, other things being the same, the resistance would be proportional to the volume of the coaches composing the train". To test this he had an experimental train made with movable sides, ends, and tops, so that the vehicles either resembled ordinary passenger coaches or, the superstructure being taken to pieces and laid flat, a train of low-sided wagons. The result of his experiments with this train were decisive. The resistance was greatly augmented when the wagons had the bulk of the coaches compared with its amount when in the form of wagons. "Thus", he writes, "was established the general principle that the resistance of the atmosphere to railway trains, other things being the same, depends on the volume of magnitude of the coaches". [We consider this anything but established, as we have noted editorially.—ED.]

We do not propose to give an explanation of a remarkable phenomenon which has never received any of that attention which it really deserves. The law is one of peculiar interest, quite apart from railways. Thus no doubt much the same thing holds good of projectiles, and it follows that alteration in the form of a bullet can have little or no influence on its range or trajectory. We may further ask ourselves: Does the same law hold good whether a body is moved through still air or wind acts on it while at rest? Does the effect of the wind to overthrow a building depend on the volume of the building or on its surface? But, perhaps, the most puzzling thing of all is to explain where or how the air exerts its retarding influence. How, for example, would the center of retarding effort be located? There seems to be some reason for asserting that, after all, it is not the displacement of the air alone, but its friction against the sides of the coaches which causes resistance. We are not aware that any experiment has been tried to settle this question, and it does not appear that the theory of friction ever suggested itself to LARDNER, WOODS or EARLE.

Kansas Law on the Removal of City Engineers.

The late case of GEORGE T. NEALLY, City Engineer of Topeka, Kansas, and D. C. METSKER, Mayor of the same city has a considerable interest for city engineers. According to the accounts in the Topeka *State Journal*, the Mayor on July 3, officially notified the City Engineer that charges had been preferred against him, and that he was removed from his office. This action of the Mayor was individual and not backed by any concurrent action of the City Council of Topeka. Mr. NEALLY did not accept his dismissal, and maintained that he was still City Engineer, notwithstanding the fact that the Mayor had appointed a successor who was in occupation of the office under police guard.

The charges referred to were made by the Mayor himself, and related to alleged neglect of duty and incompetence in the City Engineer in connection with certain street paving contracts. They were based upon a variance from the contract in the dimension and character of paving stone, the non-use of sand back of curbs when called for, and the use of an inferior cement. Without acknowledging the authority of the Mayor to remove him, Mr. NEALLY answered the charges satisfactorily; showing that the average dimensions of the paving blocks were as nearly in conformity with specifications as was usually and commercially possible. He proved by bills that the stone was bought at the only quarry supplying good material in the neighborhood, and that the cement used had been tested and approved of as coming from a reputable maker, The sand charge was proved practically false. He admitted the possibility of his making some mistakes, but denied that he had ever neglected to perform his duties with zeal and intelligence to the best of his ability, or to the best interests of the city as he believed and understood such interests. It may be said that the charges of the Mayor were general, vague and indefinite, and the City Engineer was unable to meet them separately, and demanded to have them reduced to specific instances, so that he could answer each.

The case was finally taken to the courts, and on July 30 Judge GUTHRIE rendered a decision sustaining the City Engineer for the following reasons in brief:—The office of city engineer of a city of the first-class is created by the Legislature, and is not the creation of the Mayor or City Council. The Acts of 1881 provide that the Mayor, by and with the consent of Council, can appoint a city engineer for 2 years, and until his successor is appointed and qualified, but no law is found anywhere for his removal by the Mayor. Judge GUTHRIE then in an extended manner reviews the duties and responsibility and power of the Mayor and Council. He shows that under the city charter the greater number of its provisions are mandatory, and can not be waived or dispensed with by Mayor or Council. They alone are empowered to inaugurate public works of improvement; but the Legislature has the power to decide who should superintend such work, and has ordered that it should be only superintended by the City Engineer. The Mayor or Councils may adopt or reject such plans and estimates as it is the duty of the City Engineer to make. But when the plans are adopted, and councils have let the work, it is the duty and right of the City Engineer to superintend this work, and neither Mayor or Councils can direct him.

This is one of the safeguards that the Legislature has wisely thrown around the property holder: for engineers, councilmen and aldermen may collude with contractors to wrong the people they tax. If it is the engineer that is at fault, the common law for municipalities provides a remedy in removing him from office for a just and reasonable cause, and it is in the power, and is the duty of the Mayor, with the consent of Councils, to apply this law.

But Judge GUTHRIE decided that the writ of mandamus laid is not the appropriate remedy in this case, and he so ordered. In the meanwhile, during this controversy there was confusion in the City Engineer's office; the Council refused to recognize the estimates and authority of the newly appointed engineer, and all public work was practically stopped until the case was settled.

Illuminating and Fuel Gas.

On July 11, 1888, the citizens of Akron, Ohio, by a vote at a special election, expressed their desire to establish an additional gas works in that city. CityCouncils then appointed a committee to investigate the subject of gas for fuel and light purposes as exemplified in various establishments about the country: and Messrs. FISHER, ANDREW and CASE represented the Councils on this tour, and Messrs. ROCKWELL, MAY and KUMMER were the committee from the Board of Trade; T. William Harris & Co. were the engineering representatives.

This joint committee inspected the LOOMIS process of fuel gas at Turner's Falls, Mass., the ARCHER oil gas process at Newark, N. J., and the WESTINGHOUSE system of fuel or mixed gases at Pittsburgh, Pa. The report contains a full description of these several processes, with a detail of cost and results. The committee concludes its report as follows:

"In conclusion the joint committee, after a careful consideration of all the points noted above, is unanimous in recommending the adoption of the LOOMIS system as being the most practicable for general purposes and to be obtained under the most favorable circumstances. The committee is furthermore fully satisfied that the LOOMIS gas for manufacturing, lighting and cooking purposes can be used with economy over coal, but the committee at no place saw the gas used for house heating, and is therefore unable to recommend it as an economizer for that purpose, but has the statement of Mr. LOOMIS that water gas is used and much sought after for all domestic purposes in Jackson, Mich., and Lynn, Mass., and the committee is satisfied, from the application of gas as seen by it, that the LOOMIS gas is practicable for house heating as well as other purposes, but cannot make positive statements on the point of economy in house heating."

ACCORDING to English accounts the Channel travel this season has grown to extraordinary dimensions. The average is 1,600 persons per day, or about 12,000 travellers per week cross this rough bit of water. When we think of the grim total of human misery that this traffic represents under present conditions, it seems strange that better methods are not put into practice. Better harbors and better steamers would do much to alleviate the present distress; but a tunnel would be better still, and the opposition to it can only be charged to a silly popular prejudice against the abandonment of what is called the "insular safety" of Great Britain. The world is too old for such worn-out notions.

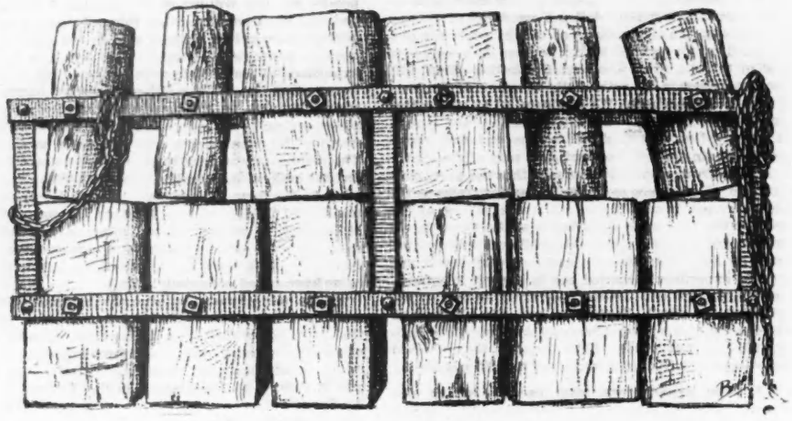
Wood Treatment Tests.

In order to ascertain the relative life and value of wood treated with various antiseptics in comparison with untreated lumber, and the relative resistance of different kinds of timber and treatment processes to the ravages of the Teredo, Mr. A. STEDMAN, Chief Engineer of the Lehigh Valley R. R. Co., has had a series of tests made at Perth Amboy, N. J., and the results of these experiments as found in the report of Mr. LOUIS FOCHT, engineer in charge of the works, are here given.

Seventy-five specimens of wood were sunk in four iron frames, arranged as shown in the figure, in sea water at Perth Amboy on March 29, 1887, and they were drawn up and examined on April 30, 1888, after 13 months immersion.

The frames were about 20 ft. apart, two containing the untreated and two the treated lumber. The specimens were full-sized pieces of piles, cross-ties and square dock lumber, each piece about 2 ft. long. The following kinds of timber were experimented upon; white oak, red oak, tamarack, white cedar, spruce pine pile, yellow pine pile, chestnut, cypress, spruce pine pile peeled and with the bark on. The antiseptics used were coal-tar, creosote or dead oil of coal tar, fernaline or wood creosote and coal oil residuum.

The general summary as given in Mr. TOCHT'S report stands as follows:



Frame for Immersing Specimens of Timber.

GENERAL SUMMARY.

Kind of timber.	Treated with creosote oil (Dead oil of Coal Tar).			Treated with Fernaline Oil or Wood Creosote.			Treated with Coal Oil Residuum.			Untreated.		
	No. of Specimens Exposed.	No. attacked by the Teredo.	Percentage Attacked.	No. Specimens Exposed.	No. attacked by the Teredo.	Percentage Attacked.	No. Specimens Exposed.	No. attacked by the Teredo.	Percentage Attacked.	No. Specimens Exposed.	No. attacked by the Teredo.	Percentage Attacked.
												Per cent.
White Oak Tie	4	.....	.....	.....	.....	.....	.....	.....	.....	3	1	33
Red " "	2	.....	.....	.....	.....	.....	.....	.....	.....	3	1	33
Tamarack "	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	2	50
White Cedar "	4	.....	.....	.....	.....	.....	.....	.....	.....	4	3	75
Spruce Pine "	4	.....	.....	.....	.....	.....	.....	.....	.....	4	3	75
Yellow pine sq. timber	4	.....	.....	.....	.....	.....	.....	.....	.....	4	1	25
" " pile	3	.....	.....	3	1	33⅓	2	1	50%	3		
Chestnut tie	4	.....	.....	.....	.....	.....	.....	.....	.....	4	1	25
Cypress "	3	.....	.....	.....	.....	.....	.....	.....	.....	3	2	66
Spruce pile (without bark)	1	.....	.....	.....	.....	.....	1	1	100%	3	1	33
Black oak tie	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Spruce pile with bark	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	1	50
Cypress pile	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1	100

[It is only fair to note in this summary that as the test pieces by the wood creosote and coal oil residium processes were only 3 in number in each case, the percentages of failure given should be rated accordingly, as compared with the 31 specimens of dead oil of coal tar treatment.—ED. ENG. NEWS.]

Mr. FOCHT then comments on this summary in his report as follows:

The specimens enumerated above have been exposed to the action of the Teredo, for nearly 13 months; the place where they were sunk is fully as exposed as any locality in the vicinity of the docks. The frames were all exposed to about the same influences, they being sunk about 20 ft. apart.

The examination of the untreated timber seems to indicate that the Teredo has a preference for the softer kinds of wood. The white-cedar, tamarack, cypress and spruce, in all cases containing more worms than the oak, chestnut and yellow pine. The yellow pine specimens were noticeably free of worms, this may be due to the pitch contained in the wood.

There was an untreated piece of cypress pile (No. 66) sunk with Frame No 2; this pile upon examination was found to contain a large number of worms. The claim, that the Teredo will not attack a cypress pile, cannot therefore be taken as general.

There were 31 specimens of different kinds of wood treated with "Dead Oil of Coal Tar Creosote" exposed; a thorough examination of every piece failed to reveal any evidence of the presence of the Teredo.

The Teredo, with but one exception, attacked the timber treated with "Coal Oil Residuum." There were three specimens exposed and two of these were found to contain a large number of worms; one of them being eaten worse than any piece of timber in the whole lot. The thick parts of the oil, which adhered to the surface of the wood when the frames were sunk, were found to be partly washed off; but the wood was still impregnated with the oil. The presence of this "Residuum oil" did not appear to prevent the Teredo from entering, as the parts of the wood containing the oil were eaten entirely through.

Frames Nos. 1 and 3 contained beside the specimens treated with the "Dead Oil of Coal Tar Creosote" and "Coal Oil Residuum" three pieces of yellow pine piles treated with "Fernaline oil"; (or wood creosote) two of these were found to be sound; but specimen No. 52 in Frame No. 1 was found to contain three large well developed worms about the size of a lead pencil. The "Fernaline oil" (or wood creosote) was not washed out of the wood in either case; for by boring in with a small auger the "oil was found to have penetrated to a depth of 2½ ins. below the surface.

After the inspection the frames were all carefully replaced in their previous positions.

Railways and Steam Tramways in Italy.

The following interesting particulars are obtained from consular reports of Mr. WM. L. ALDEN, U. S. Consul General, at Rome.

RAILWAYS.

The total length of Italian railways, on December 31, 1883, was 6,001 miles. On December 31, 1884, the total length was 6,292 miles, being an increase of 291 miles. The working expenses in 1883 were $28,626,930, as compared with $30,618,526 in 1884, being an increase of $1,991,599. The receipts in 1884 were $41,032,560, as compared with $39,784,247 in 1883, being an increase of $1,248,313. The surplus of receipts over expenses was $11,157,317 in 1883, and $10,414,034 in 1884. The total cost of all the railway lines (including rolling stock) on December 31, 1884 was $554,887,406. This gives an average cost per mile (exclusive of rolling stock) of $79,617. There was in the possession of the Italian railways, the following rolling stock in 1883 and in 1884:

Rolling stock.	1884.	1883.
Locomotives	1,913	1,807
Passenger cars	5,616	5,400
Other cars	31,740	30,450

The number of miles run by passenger cars in Italy, in 1884, was 15,382,000, and by freight and construction cars 13,642,000, making a total mileage of 29,024,000. This was an increase over the mileage of 1883 of 2,489,447 miles. In 1884, the Italian railways carried 36,358,791 passengers.

Italian railways are nearly all single track roads, but they are managed with very great care, and collisions are almost unknown. The cost of the roads has been very great, owing to the conformation of the country. Railways can be carried from the west to the east coast only by tunneling the Appennines and by steep grades, while the greater part of the coast lines from Ventimiglia to Spezia and from Naples to Cape Spartivento is a succession of tunnels. The interior of Sicily and Sardinia being mountainous has also made the construction of railways in those islands very costly.

Length of Railways in Italy in 1884.

Companies.	Length
	Miles.
Upper Italy	2,469¼
Roman	1,073
Southern	1,073
Calabrian-Sicilian	925¾
Sardinian	258
All others	493
Total	6,292

Receipts and Expenses of Italian Railways in 1884.

Receipts.	
Passengers	$15,750,429
Freight	24,619,408
Miscellaneous	662,723
Total	41,032,560

Expenses.	
Working expenses and repairs	$8,558,102
Administration	2,658,406
Traffic	9,888,805
Rolling stock	9,513,213
Total	30,618,526

A few statistics of Italian railways for the year ending June 30, 1887, together with those for the year ending June 30, 1886, have been published, but no complete statistics have been published since 1884. During the year ending June 30, 1887, the length of the railways in Italy was 7,265 miles, being 439 more miles than the statistics of the preceding year showed. The following statement shows the length of railways in 1886 and 1887:

Length of Railways in Italy during the years ending June 30, 1886, and June 30, 1887.

Companies.	1886.	1887.
	Miles.	*Miles.*
Mediterranean	2,718	2,854
Adriatic	2,834	2,968
Sicilian	404	419
Sardinian	257	257
All others	613	767
Total	6,826	7,265

The foregoing constitute all the statistics in regard to the construction of Italian railways that have been published since those of 1884. Some facts as to these railways at the present time are notorious. Among these is obvious deficiency in rolling stock. The trains are constantly overcrowded, and it is by no means uncommon for third-class passengers to be crowded into the first-class cars, owing to the lack of third and second-class cars. This deficiency is sufficiently inconvenient to travelers, but the gravest fact in regard to it is that, in case of the sudden mobilization of the army, the railways would be unequal to the task imposed upon them.

New roads are constantly being constructed. Among these are a new line between Rome and the Adriatic, by way of Subiaco, Sulmona and Pescara; a new line connecting Florence with Bologna and Ancona, by way of Faenza; a line from Spezia to Parma, and a narrow-gauge line from Arezzo to Gubbio and thence to a junction with the Foligno-Ancona road. The latter line—Arezzo-Gubbio—is now open, and the others will be open in from one to two years.

By the law of April 27, 1885, the Government leased most of the Italian railways to three great companies—the Mediterranean, the Adriatic and the Sicilian. The Sardinian railways, and about 1,240 miles in all of railways on the main-land are still operated by small companies. Most of the railway lines on the main-land are divided nearly equally between the Mediterranean and Adriatic companies.

The expenses of operating these railways have not been published since 1884. The receipts of the three great companies during the fiscal year 1887 are given below.

Receipts of the Mediterranean, Adriatic and Sicilian railway companies during the year ending June 30, 1887.

Receipts.	Mediterranean.	Adriatic.	Sicilian.	Total.
Passengers	$8,502 506	$6,803,918	$691,172	$15,997,596
Baggage	410,575	306,919	14,497	731,989
Exp. freight	2,673,116	2,107,419	66,457	4 246,972
Ordin'y freight	10,539,521	8,724,171	722,778	19.986,470
All other r'c'pts	161,417	294,009	15,793	471,219

STEAM TRAMWAYS.

During two or three years previous to 1885, a great number of steam tramways were built in Italy. These roads usually follow the line of an existing ordinary road, and the trains consist of three or four cars of about the size and very nearly the pattern of American street cars. The lines are cheaply built and operated, and as the Government does not class them as railways, they pay no taxes on freight and passengers. The increase of these steam tramways has not been as great during the year 1885 and since then, as was anticipated, since it is generally supposed that in time they will be placed under the general railway law, the effect of which would be to lessen their profits. Until the Government takes final action on this subject, investors will remain cautious as to investing in the building of new lines.

The following statement shows the length of Italian tramways in 1884 and 1885. No later statistics can be obtained:

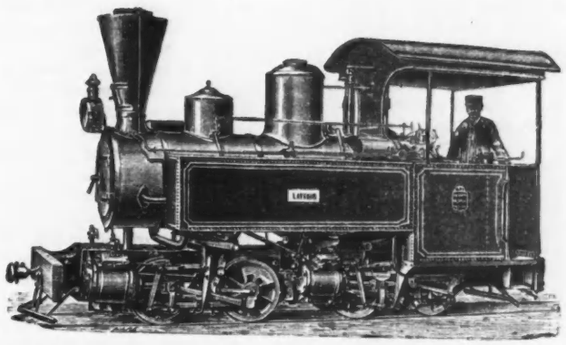
Length of Steam Tramways in Italy in 1884 and 1885.

Provinces.	Length in miles.	
	1884.	1885.
Piedmont	403¾	445½
Lombardy	438	486½
Venetia	66	101
Emilia	91¼	103¼
Tuscany	37½	37½
Rome	33	33
Campania	20	28
Pugile	40¾	46
Total	1,150¼	1,301

The extent of these steam tramways curiously corresponds with the enterprise and industry of the respective Italian provinces.

Compound Locomotive for a Narrow Gauge Tramway.

A small compound engine for a tramway with a gauge of 23.58 ins., near Laon, France, has been designed by M. MALLET, the first engineer to apply the compound system to locomotives. The engine has four axles, arranged in two pairs, each group having two coupled axles driven by two cylinders. To this extent the arrangement is similar to that of the Fairlie and Meyer systems; but in this engine there is only one truck, the two rear axles being carried in the fixed frame which supports the boiler and water tanks. These axles are driven by two cylinders, which receive the steam direct from the boiler, and the steam after expanding in these high pressure cylinders, passes by a pipe furnished with a universal joint, to the cylinders of the leading truck, which are of greater diameter, and from which the steam exhausts into the smoke stack. The truck is pivoted on the Bissell system, the weight of the boiler being supported on radial slides on the truck frame. The designer proposed to make an engine relatively powerful, but with a low weight per axle, and he has attained this object in a simple, efficient and economical manner, making all the wheels available for adhesion, while ensuing great flexibility of the wheel base. The engine



Compound Locomotive for a Narrow Gauge Tramway.

weighs about 12.6 tons in working order, which gives a maximum load of about 1.6 ton per wheel. It can pass round curves of 65.6 ft. radius.

The following are the principal dimensions: grate area, 4.5 sq. ft.; total heating surface, 9.4 sq. ft.; diameter of wheels, 23.58 ins.; diameter of high pressure cylinders, 6.68 ins.; diameter of low pressure cylinders, 10 ins.; stroke, 10.2 ins.; wheel base of each group, 33.4 ins.; total wheel base, 9.1 ft.; capacity of water tanks, 420 cu. ft.; length over frames, 15.75 ft.; maximum width, 6.23 ft. This engine, like the majority of those built by M. MALLET, is on the combined system, that is to say it can be operated either as a compound or an ordinary engine. In the latter case each pair of cylinders has independent admission and exhaust of steam; this mode of working is employed when it is desired to overcome a very heavy and momentary resistance.

The cars are carried on two 4-wheeled trucks, and are open at the side. They have six transverse seats, accommodating 4 persons each; the capacity being 32 passengers, 24 sitting and 8 standing. The three cars which form the train, carry, therefore, 96 passengers and represent loaded, a weight of 12 to 13 tons. Each car is furnish with a brake which can be operated from either end of the car. The entire train represents a weight of about 25 tons when fully loaded. The ascent of 295.2 ft. in 7 or 8 minutes, at a speed of 8 to 8.6 miles per hour, represents for gravity alone a power of about 50 H. P., which may be taken as 60 or 65 H. P. with the rolling friction, especially with sharp curves.

The tramway line runs from the railway station to the town of Laon, and follows the State road from Paris to Maubeuge, from which it only diverges for a short distance at two or three narrow places. The length of the line is about 1.25 miles, and the difference in level is about 295.2 ft. The steepest grades are 6 or even 7 per cent. at certain points, but are to be reduced to a maximum of 5.5 per cent. The radius of the curves reaches as low as 88.56 ft. and there is one horseshoe curve where a grade of 4.6 per cent. is combined with a curve of 88.56 ft. radius. The track, with a gauge of 23.58 ins., is on the DECAUVILLE system, and consists of steel rails weighing 22.78 lbs. per yard, carried on steel cross ties, of channel section, the ends of which are closed and rounded under a steam hammer, on the system of Capt. PÉCHOT. The ties are 3.28 ft. long, and there are eight in a length of 16.40 ft. The track weighs 74.3 lbs. per yard, complete. For a short distance there is used a double rail, bedded in the macadam of the road, which would be the standard track for a permanent line. The rail joints are suspended, and a sole plate is riveted under the flange of one rail end, which projects beyond the end and supports the end of the adjacent rail.

The Resignation by Sir George Stephen of the Canadian Pacific Presidency.

In tendering his resignation of the office of President of the Canadian Pacific Railway, Sir GEORGE STEPHEN presented the following statement to the company's shareholders, explaining his reason for the action.

"From the time when I became a party to the contract with the Dominion Government for the construction of the Canadian Pacific Railway and consented to accept the position of President of the company, it has always been my intention to relinquish the active chief control of the affairs of the company as soon as the task which I then undertook should be accomplished. This task was practically finished when the line was opened for traffic through to the Pacific Ocean, over two years ago; but at that time so much remained to be done toward the firm establishment of the enterprise and its future development and success, that in deference to the wishes of my colleagues I consented to continue for a time in office. Warned now by the state of my health, finding that the severe and constant strain which I have had to bear for the last eight years has unfitted me for the continous and arduous duties of an office in which vigor and activity are essential; feeling the increasing necessity for practical railway experience, and believing that the present satisfactory and assured position of the company offers a favorable opportunity for taking the step I have so long had in contemplation, I have this day resigned the Presidency of the company which I have had the honor to hold since its organization. In taking this step it may not be out of place to say that my pecuniary interest in the enterprise remains undiminished, and that the welfare of the company is and always must be to me a matter of the deepest possible interest. As member of the Board of Directors, I will always be ready to aid and coöperate with my colleagues in everything calculated to protect and promote the interests of the shareholders.

"In resigning the position of President of the company, it is to me a matter of the greatest possible satisfaction to be able to say that in my successor, Mr. VAN HORNE, the company has a man of proved fitness for the office, in the prime of life, possessed of great energy and rare ability, having a long and thoroughly practical railway experience, and above all entirely devoted to the interests of the company. In conclusion, I cannot refrain from congratulating the shareholders upon the arrangements recently completed by Sir DONALD SMITH and myself which will have the effect of securing to the Canadian Pacific Railway the permanent friendship of the two new and important American lines extending from Sault Ste. Marie to Minneapolis and St. Paul on the one hand and to Duluth on the other, and reaching a traffic the importance of which it would be difficult to overestimate. It is also a matter for congratulation that arrangements have been practically settled with the Wabash Railway for a permanent connection between the Detroit River and Chicago and the Southwest, and, further, that the long pending negotiations with the Imperial Government for the establishment of a first-class steamship line between Vancouver and Japan and China have at last been concluded."

THE passenger travel in India in 1887 amounted to 95,500,000, of whom 89,000,000 were third-class.

ENGINEERING NEWS
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EDITORS.

GEO. H. FROST, - - - BUSINESS MANAGER.

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Drawings for publication *should preferably be in plain black and white, considerably larger than they are expected to appear, with letters and figures in pencil only, all lines clean and bold.*

Coming Technical Meetings.

Engineers' Club of Kansas City, Mo.—Regular meeting, Sept. 3. Secy., Kenneth Allen, 19 Deardorff Building.

Civil Engineers' Society of St. Paul, Minn. — Regular meeting Sept. 3. Secy. Geo. L. Wilson, City Hall.

American Society of Civil Engineers, New York.—Regular meeting, Sept. 5. Secy., John Bogart, 127 E. 23d St.

Roadmasters' Association of America.—Next meeting at Washington, D. C., Sept. 11. Secy., H. W. Reid, Waycross, Ga.

Engineers' Society of Western Pennsylvania, Pittsburg, Pa.—Regular meeting, Sept. 18. Secy., S. M. Wickersham, Penn Building.

Boston Society of Civil Engineers, Boston, Mass.—Regular meeting, Sept. 19. "House Drainage". Secy., S. E. Tinkham, City Hall.

Association of North American Railroad Superintendents.—Next meeting at the Southern hotel, St. Louis, Mo., beginning Sept. 19. Secy., Waterman Stone, Providence, R. I.

American Institute of Mining Engineers.—Next meeting at Buffalo, N. Y.; beginning Oct. 2. Secy., R. W. Raymond, 13 Burling Slip, New York.

Engineers' Club, Philadelphia, Pa.—Regular meeting Oct. 6. Secy., Howard Murphy, 1122 Girard St.

American Society of Mechanical Engineers.—Convention and annual meeting at Scranton, Pa.; beginning Oct. 15. Secy., F. R. Hutton, 260 Broadway, New York.

American Street Railway Association. — Next meeting at Washington, D. C.; Oct. 17. Secy., W. J. Richardson, Brooklyn, N. Y.

THE FASSETT committee which has been investigating the New Croton Aqueduct this summer, has ceased its labors and has taken until next January to present its final report. Just what this report will be can only be guessed at now, but the real and immediate results of the committee's work can be shortly summed up. The event most prominent is the removal of a commission that had outlived its usefulness and had been sufficiently careless in its past career to warrant the action taken. And the further important result is the new commission appointed in the blaze of this investigation and under conditions which forbade its selection under normal rules of party policy and individual interest, which too often override the interest of the public in similar appointments. As far as the engineering staff connected with the Aqueduct has had to do with the investigation, their record for professional fitness and personal integrity stands unimpeached; and the point brought out in public accountant BEST'S figures that, including the Quaker Bridge dam, the engineering expenses are only about 5 per cent. of the total cost, will relieve the professional staff of any charge of undue extragavance. Considering the extent and character of the work and the multitude of officials rendered absolutely necessary for the safe conduct of the work, this proportionate charge is a small one. We have heard about bad work on the aqueduct and realize that there is considerable difference of opinion between contractors and commission as to their several interpretations of the contracts. But as the "bad work" was being made good where it did exist long before the investigation commenced, and as disputes over the letter of the contract during the final stages of a great public work are the usual thing, we have seen nothing in them calling for extended comment.

IN the Associated Press reports of the New England Roadmasters' Convention at Boston, the reporter gave a little rein to his imagination by introducing the following statement: "In the East, where gravel is used, most of the roadmasters use the broken joint; while in the West, where mud is used largely for ballast, the square joint seemed most popular." The *Railway Age*, of Chicago, in its issue of Aug. 24, quotes this report and takes up the cudgel in behalf of Western railway practice, inviting New England railroad men to take a tour in the West and see for themselves that mud ballast is the rare exception there. For the benefit of our contemporary, and in defence of the implied charge that New England railroad men are ignorant of or disposed to malign Western practice, we would say that to the best of our knowledge, no statement that mud was the common ballast used in the West was made by any member of the Convention. The statements which were made were exactly the opposite of that given by the Associated Press report. For instance, Mr. F. C. CLARKE of the Housatonic said: "Square joints may do well where plenty of good ballast is used; but with the so called ballast which most of us have to put up with, the broken joint will give the best results." The cases are very infrequent where the newspaper reports of technical matters can be relied on with any assurance of accuracy. They may sometimes be quoted with a salt of "saving clauses"; but whoever bases criticism upon them is apt to find that, like a certain famous warrior, he has been tilting at a windmill.

A RECENT editorial in the London *Iron and Coal Trades Review* takes a broad and very sensible view of the Nicaragua Ship Canal project as compared with the costly attempt at Panama. Our contemporary, while expressing the opinion that "Mr. BLAINE'S Imperialistic ideas with respect to United States supremacy over the nations of Central and South America are at present somewhat at a discount", thinks that Americans are, perhaps, not so illogical in this view as Englishmen were in the early days of the Suez canal, or even at present in respect to the proposed Channel tunnel. The *Review* says that the Americans, "with characteristic caution" have bided their time, and have launched their Nicaragua proposal at the most favorable moment. And it further gives the promoters of the American canal, credit for exhaustive surveys of the proposed field of operations, and the establishment beyond reasonable doubt, of both the feasibility of the scheme and of its moderate cost as compared with the French enterprise. From a political point of view it believes that Englishmen can find no objection to the scheme, as under the CLAYTON—BULWER treaty, still in force, the United States and Great Britain would naturally guarantee the security of the route.

This is a reception on broader and sounder grounds than is usually accorded by English journals to commercial enterprises having their origin outside of England. And while from the political side of the question, Mr. BLAINE'S ideas may or may not be at "a discount", we believe that Americans generally will agree with our contempory when it expresses the opinion that during the Panama operations our people were simply waiting—"never, however, abandoning their determination to preserve their political and commercial interests in defiance of all the engineering skill and financial resources of the Old World."

ACCORDING to the estimates of receipts and expenses for 1889, lately issued by the municipal authorities of the city of Paris, the administration of affairs will cost $64,000,000 during the next year. Of this amount $21,500,000 is devoted to the interest and sinking fund, $5,000,000 to education, $4,500,000 to charity, $5,700,000 to streets, roads and sewers, $1,000,000 to other public works, $2,000,000 to lighting, $1,000,000 to fine arts, $1,500,000 to salaries, $500,000 to firemen, etc. The chief source of revenue is the *octroi* duty collected on the meat, drink, etc., entering the city, amounting to $28,000,000; the tax proper is $7,000,000, revenue from gas companies is $4,000,000, and from water rates $2,500,000. As the population of Paris is about 2,300,000, or 900,000 more than New York, the annual expenses of the latter city (about $27,000,000) will amount to only $20 per head of our population as contrasted with $27 per head for each resident of the French capital.

THE daily press is commenting just now with virtuous indignation upon an edict of the Shah of Persia which compels a Belgian contractor to haul his material 200 miles on camels and mules to Teheran, so that the new railway can be built from that end toward the Caspian Sea, which is the real base of supplies for the contractor. This case is bad enough undoubtedly; but one far surpassing it in distances and in bullheaded adherence to established customs, regardless of changed conditions, can be found much nearer home. The Mexican National Railway Co. is now completing the gap in its line between Mexico and the United States and conditions compel certain work from the Mexican end. Their steel rails are bought in England and the natural route to the Mexican capital would be *via* Vera Cruz and the 264 miles of railway intervening. But unfortunately this is an English road with freight rates established on the crabbed monopoly basis; and the National company finds it is cheaper for it to land its rails at New Orleans, send them about 1,162 miles west to El Paso and then 1,224 miles south to Mexico, than to pay the charges demanded over the 264 miles of Mexico-Vera Cruz railway. About the time the National road has its connecting lines completed, the English managers will probably discover that they have lost some considerable amount of freight and the profits thereon; for it is almost too absurd to suppose that even this phenomenal 264 miles of road could not compete at some profit with over 2,000 miles of American managed track.

U. S. Senator GEORGE in the midst of a late lengthy speech on retaliation, Anglo-American treaties, Canadian canal tolls, etc., was compelled to admit to Senator FRYE, that he did not know where the Sault Ste. Marie Canal was, nor anything of its traffic or importance. Considering that its volume of traffic exceeds that on the Suez Canal and that its locks are the largest in the world, Senator GEORGE hardly seemed sufficiently well equipped to properly discuss a matter in which this canal is concerned.

Train and Air Resistance.

We find in a late issue of *The Engineer* an editorial on "Train Resistance", chiefly confined to records of some earlier and now almost forgotten train resistance tests, which, as *The Engineer* well remarks, were made with a delicacy and care well entitling them to permanent memory. Partly for this reason, and partly because it seems to us more than questionable if the records support as extended conclusions as are drawn from them, we reprint the greater portion of the editorial elsewhere. We are sure all those interested in its subject matter will find it well worth reading.

We must confess we were not aware that there were any experiments of so early a date dealing with the effect of the form of the train and especially of the head of the engine, on air resistance. The whole theory of air resistance, despite all that has been written upon it in later days as a result of such events as the Tay disaster, is still in a very crude, inchoate and indeterminate state. SMEATON made a shrewd guess (for it was little more) nearly a century ago, that the pressure of air against a flat surface at right angles to it was about ½ lb. per square foot at 10 miles per hour, and increased as the square of the velocity; or, by formula:

$$P = 0.05\ V^2$$

His great name gave this formula a credence far greater than it deserved; and it has remained ever since, and is now, the only definite and generally accepted formula for air resistance known to the profession. A great variety of experiments and observations have been made since, it is true; but they have been very partial ones, designed to cover special conditions and problems, and in no respect of such scope as to settle even the fundamental laws of air resistance, as for instance, how it varies with velocity, how it is affected by the area and shape of the surface, by its angle to the direction of the wind, by the bulk of the body exposed to the wind, and so on. Even the assumption that the resistance varies as V^2 is pure assumption. It is known not to hold with the high velocities of projectiles, the resistances of which are much more nearly as V^3. The effect of the form of the surface or bulk of the body on the resistance is still less adequately known.

Many observations of apparent credibility show nearly double the resistance of SMEATON's formula, yet if we compute what the resistance of railway vehicles should be even by that formula, we see that it is impossible that it should hold true for that class of surfaces or bodies at least. Thus the least reasonable cross-section for a train is about 9 ft. wide by 12 ft. high or 108 sq. ft. By SMEATON's formula this area would cause a resistance at various velocities of

20 miles per hour	216 lbs.
30 " " "	486 "
40 " " "	864 "
50 " " "	1350 "

If now, we take a single box-car of this cross-section, weighing 10 tons and assume it to have only 5 lbs. per ton rolling resistance (50 lbs. in all) in addition to the air resistance, we shall find that the necessary down grade to give these successive velocities to such a car will be:

20 miles per hour	$\frac{266}{20{,}000}$	or 1.33 per cent.
30 " " "	$\frac{536}{20{,}000}$	or 2.68 "
40 " " "	$\frac{914}{20{,}000}$	or 4.57 "
50 " " "	$\frac{1{,}400}{20{,}000}$	or 7.00 "

On a grade of 40 ft. per mile, or 0.76 per cent., the highest velocity possible would be

$$V = \sqrt{(15.2 - 5) \times 10} = 10.1 \text{ miles per hour.}$$

According to this we might let box-cars loose with perfect safety on any of the steepest grades of the world; and on any ordinary grades, however long, they would barely creep along. It needs but the most superficial knowledge of facts to know that this is not so at all, and hence that SMEATON's formula, which figures so extensively as a standard, is either wrong in principle or far out in its constants.

It is altogether probable that it is both, but chiefly wrong in principle; that air resistance is in no respect a function of the exposed area merely, but in much larger degree, at least, of the bulk of the exposed object. This, at any rate, goes far to explain the indifference to form which is shown in the proportions of all forms of rolling stock The air, after all, is only a fluid, and reasoning by analogy we should expect that the laws of motion through it would be much the same as through water, where form is very important. In the case of projectiles we know this to be so, because round projectiles have much less resistance than square ended ones, and pointed projectiles still less than round. The suggestion of the *Engineer* that the form of projectiles can have little effect on their speed resistance has been disproved by experiments. But in railway trains, although to all appearance their motion should be governed by the same laws as projectiles, no attention, whatever is paid to form, and those who have wondered at, and questioned the propriety of such negligence are now confronted with some early experiments which seem to confirm the correctness of such negligence, by proving that the addition of wedge-shaped form does not reduce the resistance in the slightest.

That they, in fact, prove this last extreme allegation, however, we have no belief. The experiments are not of sufficient extent to do this, and it is contrary to reason. Some recent French experiments, moreover, have shown a very appreciable effect at high speeds, something like 10 per cent., from adding bevelled peaks to the flat surfaces of engines. That the effect is much less than might be supposed, however, and that the French experiments err by excess, we fully believe, and there is some little modern evidence to prove it.

LARDNER's "general principle" which he declares to be "established", that "the resistance of the atmosphere to railway trains, other things being the same, depends on the volume or magnitude of the coaches" and in no respect on their cross-sectional area, is plainly not literally true. If it were, since the ratio of bulk to weight would be the same in any number of similar coaches as in one, a train of any number of them would attain only the same velocity as one alone, in running down a grade. But this is not the case. Two cars coupled together will attain a much higher velocity than one alone, three than two, five than three, and so on; but it is true that the difference is much less than would be expected, and much less then would be called for by SMEATON's formula. The longer trains will attain about the speed called for by his formula, but the shorter trains of one, two and three cars will attain a very much higher speed than SMEATON's formula will permit, not falling so very greatly below that of the longer trains, although still decidedly below it. This was determined in the experiments made by Mr. WELLINGTON at Cleveland, O., in 1878, which are the only ones of the kind known to us covering this special point. In his report of these tests (Trans. Am. Soc. C. E., Feb., 1879), the writer stated the results of these observations as above outlined, stating that they proved conclusively that head resistance proper could not be so important an element as was supposed, and must be less than ½ lb. per sq. ft. at a velocity of 10 miles per hour; but instead of adopting the conclusion of Dr. LARDNER that air resistance must, therefore, be as the total bulk regardless of form, rather than as the area exposed, Mr. WELLINGTON reached the conclusion that the larger velocity resistance which did not seem to vary with cross-section or side area, was in reality not due to air resistance at all, but to oscillation and concussion, expressing the conclusion, in the following words:

"About two-thirds of the velocity resistance proper, excluding axle friction, is due to oscillation and concussion. The resistance due to the latter cause may be estimated at ½ lb. per ton at 10 miles per hour, varying as the square of the velocity."

Which of these conclusions is correct? So far as concerns the difference observed with cars of large and small bulk, or the close approximation in velocities of long and short trains running down grade, either may be correct, and that of Dr. LARDNER seems intrinsically the most reasonable and probable, since it is difficult to see how any large amount of velocity resistance can come from oscillation and concussion, the common assumption being that all additional resistance due to velocity must come of necessity from atmospheric resistance and nothing else.

But when we come to comparison of loaded and empty trains which are otherwise the same a serious difficulty arises, tending strongly to support the oscillation and concussion theory. Dr. LARDNER's experiments do not appear to have extended to comparisons of loaded and empty trains otherwise similar; it is a great pity they did not, since he would otherwise have detected a serious defect in his bulk theory, which seems to positively disprove it, and we might have had an authoritative determination of the real facts half a century ago, instead of having to wait for it still.

If the bulk theory were correct, when we took an empty car or train whose velocity resistance had been determined and placed a load within it, the absolute amount of the velocity resistance would not increase and hence the velocity resistance *per ton* would be very greatly decreased (*i. e.* reduced to ½ to ¼ of what it was before), since the total resistance —by assumption remaining uniform—is divided up among two or three times as many tons. This is very far indeed from being the case. So far is it from being true that, although there is certainly a decided decrease per ton in the velocity resistance, yet it is much more nearly constant *per ton* than constant in aggregate, standing about in the ratio of 1.67 to 1 for weights of 2 to 1, the outward form of cars remaining constant. This remains true whether we take roofed box-cars and place the load within them or take "gondola" cars (flat cars with sides, we may note for the benefit of foreign readers) and place the load within the box, which alters slightly but not much the form of the upper part of the car.

So far as we can perceive, this completely disproves the theory which Dr. LARDNER enunciated and *The Engineer* repeats with so much emphasis, and thus again illustrates the immense danger of accepting the apparent indications of experiments until they have been so far extended as to make it certain that they include all conditions. Dr. LARDNER's conclusion seems even at this late day the most probable assumption from his experiments so far as they went; and it cannot be asserted yet that it is positively dis-

proved, for that can only be when some other specific theory has been affirmatively established. There may well be sources of error still undetermined, as for instance fluctuations in the axle and rolling friction with speed, which will again alter the status of the question; but in the form and on the evidence originally given, the bulk theory of atmospheric resistance, and with it the allegation that all velocity resistance is atmospheric, necessarily must be abandoned.

Having these fundamental facts determined, we may readily detect various other inconsistencies in the theories and alleged facts given elsewhere. Thus it is recorded that "to make certainty doubly certain" in the rather loose words of *The Engineer*, "a front was constructed of boards projecting 2 ft. all round the end of the leading carriage. This also was found to have *no effect whatever* (italics ours); in *no* way retarding the train". If this were true, then a projection of 3 ft. 6 ft. or 10 ft. around the carriage should likewise have no effect, and a fan or a board should be waved through the air no easier edgewise than flatwise; while a cubical bird (!) should pass through the air as easily as those of the shape which we alone find in nature. We are quite prepared to believe —in fact it necessarily follows from all the facts we have narrated—that the effect of such projections would be vastly less than was expected, but that there should be no effect is impossible, and that there should be so little may be explained in two ways, either by the bulk theory of LARDNER or by the assumption which seems to be required by the other facts mentioned, that atmospheric resistance is so small a fraction of the total velocity resistance that a little addition to it had a very trifling effect on the aggregate.

That atmospheric head resistance proper, however, is a very considerable fraction of the total train resistance at high speeds seems to be proved in one way very conclusively; by the enormous disproportion between the indicated horse-power and the power transmitted back of the engine to the cars when trains are running at high speeds. We cannot now take space to go into details as to precisely what this disproportion is, but in a general way the facts are these: that whereas at slow speeds only a slight disproportion in the indicated and transmitted horse-power exists, say some 10 per cent. due to the friction of the engine, at high express speeds 30, 40, 50 per cent. and more of the total work done by the engine is consumed within itself, and only what is left over goes back to the train, requiring it to be made much shorter to be hauled at all, while at 60 miles per hour, on a long level grade, an ordinary engine can do little more than propel itself.

There is a great field here for further exhaustive experiments, partial experiments are of little worth. It is to be hoped that some competent engineer will ere long undertake them, as the possible results might be very important. The subject invites further discussion, but at this time we cannot attempt it.

The Payment of Ticket Commissions.

Nearly a year and a half ago the members of the Trunk Line Association agreed to put forth a united effort to stop the long established practice of paying commissions for the sale of tickets over any company's road by others than its authorized agents. The practice is an old one, and has grown up largely from the rivalry between the principal Western systems in working to turn the current of travel from the East, largely composed of probable settlers, over their own lines. Most of the Western lines acceded to the proposition; but the Chicago & Alton, for reasons best known to its managers, refused to stop the payment of commissions, and the Trunk Line Association, therefore, boycotted it by refusing to permit the sale of tickets over that road in any of its offices.

Recently, however, matters in the Trunk Line Association have become anything but harmonious. The Delaware, Lackawanna & Western and the New York, Ontario & Western, are now working independently and have offered commissions for the sale of immigrant tickets over their lines. Commissioner PIERSON, of the Trunk Line Association, to meet this competition reduced the rate to $5 from New York to Chicago (the standard rate has been $13), and sent to the Western managers to secure their consent to make similar reduced rates to St. Paul, Missouri River points and San Francisco, over their lines. This was the opportunity of General Passenger Agent CHARLTON, of the Chicago & Alton, and he promptly gave notice that turn and turn about was fair play, and as the Trunk Line Association had boycotted the Chicago & Alton, they could hardly expect that company to assist them in fighting their battles. Mr. CHARLTON declared that an American had as good a right to ride cheaply as a newly arrived foreigner, and that if his company had to reduce rates on immigrant traffic, it would do so on first and second class passenger traffic as well. The Western companies are belligerent enough for almost anything, but the prospect of a wholesale slaughter of passenger rates all over the West, while freight rates are still in a demoralized condition, was a little too bad even for them, and it is certain now that the war in immigrant rates will not affect others than the trunk lines. Besides this, the Chicago & Alton has carried another point in securing a removal of the boycott against it. The Baltimore & Ohio, New York, Ontario & Western, and Cleveland, Columbus, Cincinnati & Indianapolis have formally declared that the sale of Chicago & Alton tickets will be resumed at their offices, and a number of other lines are selling the tickets, though nominally still maintaining the boycott.

If the question were merely an ordinary one of rivalry between competing roads, we would not think it worth while to call our readers' attention to it. But the principle involved is so highly important to the railroad interests of the country, and its correct solution is so necessary to the stability of that revenue for which railroading, like every other business, is conducted, that it deserves a broader discussion than it has yet received.

It will doubtless be acknowledged at the outset that in the words of Judge COOLEY, of the Interstate Commerce Commission, "Rates of all kinds should be kept uniform, so that every one may know exactly what he is doing." To have rates reduced without warning or put up at a short ten days notice to a point out of all proportion to their former status, is an injury to business of every sort as well as to the railways. It renders the revenues of the latter uncertain, and thus, losing credit in the eyes of the investing public, a greater proportion of their earnings has to go to the payment of interest on the capital invested than would be the case if their revenues were more sure and steady. We may state then without fear of contradiction, that a guiding principle of railway management should be the maintenance of rates without fluctuation at the point which will ensure the greatest net returns to the railway permissible with proper regard to the rights of its patrons. Also that this revenue should be collected with as little expense as possible, and that to insure justice to all, patronage of the same class should have the same rates. These ends will never be effected by the prevalence of that unlimited competition known as a rate war. They can be effected by the maintenance of uniform rates by agreement between the different roads carrying business between the same points.

The question to be discussed here is, whether that modified form of competition which permits the company to attempt to draw trade from its rivals by giving a part of its profits to sellers of its tickets not in its own employ, tends to bring about those results which we have stated to be desirable. The first effect of the payment of ticket commissions is, plainly, to reduce the profit to the railway on each ticket sold, unless, as may possibly happen, the total revenue to all the roads is enough greater, on account of the persuasive powers of the agents, to induce a heavier traffic. But it is not at all probable that this can be the case. No one expects it. The payment of commissions is started by one company to get ahead of its rivals, and the other companies have to follow suit. So also when any line increases its commissions, its competitors must do the same. Thus the practical effect at first is to put a good share of the profits on the ticket into the ticket seller's pocket instead of into the railway company's treasury. Now it may be said that this is not a bad thing after all, as the ticket seller is often a poorly paid employé and the railway company is "a rich monopoly" so that it tends to even things up a little. Without acknowledging at all the justice of this argument, its force is taken away by the fact that the process does not terminate here. The rivalry between different agents and between agents of different lines causes the ticket seller to divide the commission with the purchaser, provided the latter is sharp at a bargain. Thus it comes about that different patrons travel on very different rates of fare, and that much of the profit which rightfully belongs to the railway is diverted to outside ticket dealers and bargain seeking travelers. The climax is reached when a road sells tickets at its own offices at the tariff agreed upon with its competitors, and at the same time secretly supplies "scalpers" with its tickets at a smart reduction from the regular rates.

Who will deny that these are abuses which the good sense and business tact of railway managers ought to correct. It is difficult to see how it is to be done, however, while the payment of ticket commissions is permitted; or how, so long as that custom is in vogue, the most solemn and formal passenger traffic agreement is much more than a farce. The ideal of perfection in transportation rates will be closely approached when they are as stable as the rates of postage, and when it will be as impossible for regular tickets to be bought at reduced prices from outside parties, as it is now to buy postage stamps at a discount. That point of perfection is, doubtless, a good way in the future. But with other interests on every hand combining against them, with adverse legislation threatening all through the West and South, it behooves the railways of the country to understand that they cannot afford to spend their energies in fighting each other, or in paying scalpers of any sort for stealing one another's traffic.

AT Pittsburg, Pa., a resolution has been adopted by the Council directing the Finance Committee to inquire into the value of the rights, franchises, grants and property in the city, held by the telegraph, telephone, electric-light, natural gas and artificial gas, street-railway (including cable lines) and water companies, and all other corporations with a view of having said property placed on the assessment lists for the purpose of city taxation. Should legislation be required, the committee is requested to prepare the same and report at the first regular meeting of October.

Abandoning Unprofitable Railway Lines.

It is a well-known fact that the division of the Pennsylvania system, known as the United Railroads of New Jersey, has been running behind for some time. The managers of the system have evidently concluded that, as there is no reason to expect the traffic to develop enough to make the lines profitable property, it will hardly pay to operate them merely for amusement. The Pemberton & Hightstown road was the first to be abandoned, and it is now announced that the same course will soon be taken with the Mt. Holly, Lumberton & Medford road. As already recorded in these columns, the residents along the line of the Pemberton & Hightstown were greatly upset at this unexpected move on the part of the Pennsylvania. They proposed legal proceedings; but it seemed plain that they could hardly force a company to continue in a losing enterprise because it benefited some one else. Finally, when they found, by the actual abandonment of the line, that the Pennsylvania Company really meant business, they organized a stock company, leased the line from the Pennsylvania, and are now operating it; well persuaded, no doubt, that it is sometimes easier for a railroad to get along without the public than for the public to get along without a railroad. It is quite probable that the roads which may be hereafter abandoned, will go through the same course; for a community which has once had railway facilities finds it difficult to do without them if they can possibly be afforded. But consider the matter a little further. The Pennsylvania has found it impossible to make these lines pay their running expenses and fixed charges. It is certain that a local company, if they maintain the same traffic rates, will lose still more heavily. Either this loss must be borne by the men who operate the road, or else they will have to raise the rates of fare and freight until receipts become sufficient to pay the operating expenses and the rent. It can hardly be expected that the men who operate railroads will do so out of pure philanthropy, and when the inhabitants along the line understand that they must make the choice between paying for railroad transportation what it costs, and doing without it altogether, they will be apt to accept the higher rates without making the usual howl about "grasping monopolies."

The popular idea of railway rates is that they should all be alike in the same section of the country; so if a trunk line with a heavy traffic, charges two cents a mile, the residents along the line of some of its local feeders which charge four cents, consider themselves ground down by a relentless monopoly. The fact is, that if rates were fixed on a perfectly equitable basis, many of the trunk lines would have to bring down their rates still lower, and rates on local lines would rise far above where they are at present. Managers of railway systems generally defer to this popular prejudice, and make low rates on their branch lines, which often do not pay expenses, save as feeders to the main line.

In this case the loss on one hand is offset by the gain on the other, and the only people who have cause for complaint are the patrons of the trunk line, who pay for railroad transportation more than their just share to make up the deficiency in the receipts from the local lines.

Were it not for this strong, popular prejudice, which bristles up the instant it is proposed to raise local rates and rates on local lines to a paying point, and is apt to vent itself in meddlesome legislation, it would be much better for all parties concerned if the great systems, instead of abandoning their unprofitable lines, would raise their traffic rates to a point sufficient to make it fairly profitable to operate them. As is well known, the cost of operation as a part of a large system is much less than when run as an independent local road. Thus the patrons would secure their transportation facilities at less expense if they would consent to an advance in the rates while the road still remained a part of the main system.

This question is a new one in railway practice. Heretofore the growth of the country has been such that almost every line could expect to some day become a profitable property. Cases of the abandonment of a railway once in operation have been very few. But unless on many of the local and branch lines, patrons will submit to a material advance in traffic rates, cases of abandonment are certain to be very much more common in the future.

The Loss of the Main Channel False Works of the Huntington Bridge.

WE regret to note that the Phœnix Bridge Co., of Philadelphia, on Aug. 26, lost the falsework and traveler for raising the channel span of the Ohio River bridge, at Cincinnati, Ohio. The span is part of a structure which is over one mile in length, carrying double track railway, two roadways and two sidewalks; the river being crossed by three spans—two 400 ft., and a channel span of 550 ft., being the longest simple truss ever made and the heaviest per lineal foot. The Covington approach, some 1,500 ft. long, is finished, as is also the 400 ft. span on the Kentucky side, the latter being erected in just one month, during which the very unusual rise of 33 ft. in July and a heavy run of drift was successfully combated. The Bridge Co., fully aware of the treacherous character of the Ohio river, designed falsework of the heaviest description, everything being done in the most substantial manner. Double bents were placed under main panel points, 5 ft. apart, other bents being 16 ft. centers. Falsework was 60 ft. wide on top, 80 ft. wide at bottom, and 78 ft. high from pile cap to top cap. Under each bent 12 piles about 60 ft. long, driven 18 ft. into bottom with 2,600 lb. hammer falling 24 ft., moving only 1 or 2 ins. at last blow. Piles were thoroughly braced within 18 ft. of bottom. Falsework bent consisted of 5 legs, 10 ins. × 12 ins., and 4 legs, 12 ins. × 12 ins. Top, middle and bottom caps two 7 ins. × 14 ins.; bracing, 4 ins. × 12 ins. transversely. Longitudinal bracing, 7 lines 3 ins. × 12 ins. at each cap, and X bracing every fourth or fifth bent. On top, 22 lines of 8 in. × 16 in. stringers, and 3 in floor planks, and on these rails for traveler. At time of rise, falsework was not quite finished, there being an opening of several bents near the Ohio pier. This part not being finished from pier to pier, proved a source of weakness longitudinally. Provision had been made to guard against high water and drift, and at the first warning the cluster of 50 or 60 piles for V-shaped bulkhead, 550 ft. up stream from center of span, was finished, thoroughly braced and sheathed on outside with 3-in. planks. From this bulkhead lines of barges were run to each pier, and two lines of barges across this triangle on inside to act as struts. This plan worked very well until the water had risen 8 ft. or 10 ft. and while drift was comparatively light.

On Friday August 24, the line of barges on the Kentucky side were bent in and drift began to collect in the bend; lines were run from this point to shore and every effort made to hold the barges back, but without success, the heaviest manilla ropes were snapped in two, and wire cables also; and early Saturday morning the barges, under the tremendous pressure, broke loose and with the drift settled back against the falsework. Drift continued to accumulate and finally filled the triangle included between piers and bulkhead, and still the falsework bore the test, having only moved down stream in a gentle curve about 6 in. and toward Ohio shore 3 in. Water had been rising steadily since Tuesday and heavy drift running since Wednesday, and for hours at a time the river was bank full. On Saturday the water had reached a stage of about 40 ft. at the bridge and the current then seemed to change, carrying by far the greater accumulation of drift toward Kentucky side of triangle; this produced a tremendous force longitudinally (the weakest part of the falsework, they not being complete) and the effect was soon seen in the piling and lower half of trestle, on up-stream side; these were bent out of plumb and towards the Ohio side. Nothing could be done to stop this, and at 10 o'clock Sunday morning August 26, 1888, the lower caps were broken near center, the piles gave way and the whole structure came down; settling down and leaning slightly up-stream; drift began moving immediately and passed out with wreck, leaving clear water between piers in less than 3 minutes. This shows clearly that the drift had no support on bottom as had been hoped, and speaks volumes for the strength of a falsework which would sustain for two days such a tremendous pressure.

These two heavy rises in the summer within one month of each other were unprecedented, never before did a rise of any magnitude occur in July; and with each there was an unusual run of heavy drift, that in August being longer and heavier than ever noted by the oldest steamboat men; at least 450 miles of drift passed through during the four days and three nights. The wreck was landed by steamers along the shores below and while very much broken, considerable will be saved. Measures have already been taken, and mills are already at work on timber piles; increased force will be put on, and by working day and night it is hoped there will be no material delay in the final completion of structure.

PERSONAL.

Capt. GEORGE COLLIER, of Lexington, Ky., has been appointed Roadmaster of the Maysville & Big Sandy R. R.

JOS. P. MCLAWS, an engineer on the construction of the Southern Pacific R. R. line between Crocker and Carbonado, Wash. Ty., was crushed by rocks from a blast on Aug. 1.

P. C. RICKETTS, of the Rensselaer Polytechnic Institute, has been appointed engineer for the Hawk St. Viaduct Commissioners, Albany, N. Y., at a salary of $2,500 for the entire work.

F. M. MARSH has been appointed Superintendent of Bridges and Buildings of the Fremont, Elkhorn & Missouri Valley R. R., (Chicago & Northwestern), with headquarters at Omaha, Neb.

RALPH PETERS, Superintendent of the Little Miami Division of the Pittsburg, Cincinnati & St. Louis Ry., has had the recently acquired line between Richmond and Red Bank Junction added to his supervision.

THOMAS T. BEALL., who has been employed with the engineering corps engaged on the construction of the Cincinnati & Richmond Railroad, has gone to Pittsburg.

J. C. MOORHEAD, Assistant Division Superintendent of the Canada Southern Division of the Michigan Central, has resigned to accept the position of Division Superintendent of the New York, Pennsylvania & Ohio.

IN the items in last week's issue in reference to W. A. SPROUL and GEO. E. MERCHANT, "Western New York & Pennsylvania Railroad" should have read, the Buffalo, Rochester & Pittsburg Railway.

MRS. ANNA MARIE LOW, wife of SIGISMUND LOW, C. E., of Pittsburg, Pa., died at the family residence in that city on Aug. 13. Mrs. LOW was the mother of seven children, the two eldest of whom are EMILE and THEODORE LOW, the civil engineers.

H. C. POTTER has resigned as General Manager of the Flint & Père Marquette R. R. Assistant General Manager EDWARDS will have full charge of the passenger and freight traffic of the company, and Superintendent S. KEELER, will have charge of the motive power and transportation, both under the general direction of the President.

IT is reported that J. J. HILL, President of the St. Paul, Minneapolis & Manitoba R. R., will resign, and that General Manager MARVEL will succeed him. A. L. MOHLER, General Superintendent, will be General Manager, and Superintendent C. W. CASE, of the Chicago, Milwaukee & St. Paul R. R., will be General Superintendent.

CHARLES FRANCIS ADAMS, President of the Union Pacific R. R., has issued a circular announcing that owing to the illness of Acting General Manager KIMBALL, and at his request, General Purchasing Agent C. S. MILLER has been designated to perform the duties of assistant to Mr. KIMBALL until otherwise ordered. All papers which would have been addressed to the Acting General Manager will be forwarded to Mr. MILLER, who will take action accordingly with full power and authority of the Acting General Manager.

PUBLICATIONS RECEIVED.

The Saegmuller Solar Attachment, How to Adjust and Use it, with Solar Ephemeris and Refraction Tables.—This is a pamphlet issued by FAUTH & Co., manufacturers of engineering and astronomical instruments, Washington, D. C., and describes the Saegmuller solar attachment for transits, by means of which the astronomical meridian may be accurately obtained in a few minutes. The Solar Ephemeris and Refraction Tables will be published every year, and will be mailed to anyone who sends his address to Fauth & Co. The pamphlet also contains descriptions and prices of instruments.

Institution of Civil Engineers.—The following are the latest papers received: "Effect of Temperature on the Strength of Railway Axles", Part 2, by THOMAS ANDREWS; "The Tay Viaduct" by CRAWFORD BARLOW and WILLIAM INGLIS, with discussion; "Prevention and Extinction of Fires", by ALFRED CHATTERTON; "Steam Engine Governors", by Prof. DWELSHAUVERS-DERY; "Distribution of Hydraulic Power in London", by E. B. ELLINGTON, with discussion.

Massachusetts Institute of Technology. Abstract of the Proceedings of the Society of Arts for the 26th year.—Published by the Institute, at Boston, Mass.; 141 pp.

The following is a list of the papers abstracted: "Arms and Armor of Ancient Japan", by TATUI BABA; "An Electrical Apparatus for the Measurement of Water", by N. M. LOWE;" The Cosmosphere in Teaching Phenomenal Astronomy", by F. H. BAILEY; "Hydraulic Cement, Natural and Artificial: their Comparative Values", by U. CUMMINGS; "The Strong Locomotive", by GEO. S. STRONG; "Recent Improvements in Systems of Electrical Distribution", by WM. STANLEY, Jr.; "A Biological Examination of the Water Supply of Newton, Mass.," by W. T. SEDGWICK and S. R. BARTLETT; "A New Method for the Biological Examination of Air", by W. T. SEDGWICK and G. R. TUCKER; "Steam Engine Experiments in the Mechanical Engineering Labratory of the Mass. Inst. of Tech.," by A. J. PURINTON; "A General Review of Steam Engine Tests", by C. H. PEABODY; "The Manufacture of Paper, and its Uses", by WM. A. RUSSELL; "Natural Gas", by L. M. NORTON; "Standards of Length, and their Practical Application", by GEO. M. BOND; "Chemical Examination of Drinking Water", by T. M. BROWN; "Johnson Heat Regulating System", by WM. F. CHESTER; "Causes of Recent Floods in Germany", by WM. H. NILES; "The Development of Bridge Building", by GEO. F. SWAIN; "Precious Stones in the Last Decade", by GEO. F. KUNZ; "A Study of Alternating Current Generators and Receivers", by WM. A. ANTHONY.

Proceedings of the U. S. Naval Institute. No. 3, Vol. XIV. Published by the Institute, at Annapolis, Md.

The most interesting paper is one on "Torpedoes", by Lt. Comm. W. W. REISINGER, U. S. N., being the prize essay for 1888. Other papers are "Recollections of the Mexican War", by Lt. S. C. ROWAN, U. S. N.; "Naval Administration", by Rear-Admiral S. B. LUCE, U. S. N.; "Comparison of Hotchkiss & Hebler Rifles, with Arguments Favoring the Reduction of Calibre", by Ensign M. K. EYRE U. S. N. The department of Professional Notes contains notes on "A Proposed Non-Sinkable Battle Ship, with a Constant Water Line", "Deep Sea Sounding Machine", "Submarine Electric Illumination", "Gyroscopic Torpedoes."

Specifications for Steel Rails and Track Fastenings.

The following specifications for steel rails and track fastenings are those drawn up and used by FRANK WARD & Bro., of Pittsburg, Pa., in their inspecting work; they are published for general information and as a concise, clear form for similar documents. As the specifications for carbon may not suit some users of rails, these as well as other points can be changed to suit individual demands:

SPECIFICATIONS FOR STEEL RAILS.

Adopted September 1, 1888.

1. ***Steel.***—The steel used for rails shall be made in accordance with the "Bessemer" or "Open Hearth" process, and contain not less than thirty (30) nor more than fifty, one-hundredths ($\frac{50}{100}$) of one per cent. of carbon and not more than ten one-hundredths ($\frac{10}{100}$) of one per cent of phosphorus.

2. ***Chemical Tests.***—Determinations of the amount of phosphorus, manganese, sulphur and silicon shall be made, when desired by the inspector, and the results of such determinations shall be furnished inspector. The results of the carbon test of each charge shall be given to the inspector.

3. ***Physical Tests.***—Upon request of the inspector, physical tests of each charge shall be made. Either drop test or that of a test bar ¾ or 1 in. thick and about 10 ins long, bent cold to an angle of 90 deg. without fracture.

4. ***Section.***—The section of the rails shall conform accurately to templates furnished to contractor.

5. ***Weight of Rails.***—The weight of rails shall be kept as near as possible to standard weights.

6.—***Marks.***—The place and date of manufacture shall be marked in plain letters and figures on the side of the web of each rail. The number of charge shall also be plainly marked on each rail.

7. ***Sawing.***—The ends of rails should be sawed square and smooth.

8. ***Length.***—The length of rails at sixty (60) deg. Fahr. shall be kept within ¼ in. of standard lengths.

9. ***Straightening.***—Rails shall be straight in all directions, without twist and free from gag marks.

10. ***Drilling.***—Circular holes shall be drilled—not punched—through the web of rail at equal distances from the upper surface of flange and lower surface of head. Distance from center to center of holes and from end of rail to be according to drawings furnished to contractor. Holes to be clean drilled, leaving no burrs.

11. ***Finish.***—All rough edges at the ends of rails and at the drilled holes shall be well trimmed off and filed.

12. ***Fit of Splice.***—The space between the web of rails and the template representing the splice bar shall not be les than ¼ of an inch nor more than ⅜ of an inch.

Appearance in General.—The rails must be smooth and compact, and free from flaws, honeycombs and blisters.

The Causes for a Temporary Rejection of Rails are:

1. Crooked rails.

2. Imperfect ends, which after being cut off would give a perfect rail of one of the standard lengths.

3. A variation of more than ¼ in. from standard lengths.

4. Missing test reports.

The Causes for a Permanent Rejection of a Rail as a First-Class Rail:

1. A bad test report.

2. The presence of a flaw of ¼ in. in any part of the rail.

3. A greater variation between the rail and splice bar than allowed in paragraph 12.

4. The presence of such other imperfections as may involve the possibility of the rail not giving good service in track.

SPECIFICATIONS FOR TRACK FASTENINGS.

Adopted September 1st, 1888.

All splices, bolts and spikes are to be made strictly in accordance with drawings furnished to contractor.

All the iron to be tough and fibrous, of uniform quality throughout, free from flaws, blisters and cracks, and must have a workmanlike finish.

Splices.—All iron for splice bars must be capable of sustaining an ultimate stress of 45,000 lbs. per sq. in., with an elastic limit of not less than 20,000 lbs. per sq in., and an elongation of not less than 12 per cent., measured on a length of 8 ins. All holes for splice bolts must be punched *from the inside of the splice bar.* Special care must be exercised to have all edges of splice bars well and accurately defined, and that the outside surface of the web part of the same be perpendicular to the line of the base of the bar.

Bolts.—All iron for bolts must be capable of sustaining an ultimate stress of 46,000 lbs. per sq. in., with an elastic limit of not less than 23,000 lbs. per sq. in., and an elongation of not less than 15 per cent., measured on a length of 8 ins., and should be capable of bending to at least a right angle without showing any sign of fracture. The nuts must be tapped to fit threads on bolts accurately. The face of nut must be at right angles to axis of bolt.

Spikes.—The iron for spikes to be tough and fibrous, of uniform quality throughout, free from flaws, blisters and cracks; they must have a workmanlike finish, and be capable of sustaining an ultimate stress of 45,000 lbs. per sq. in., with an elastic limit of not less than 20,000 lbs. per sq. in., and an elongation of not less than 12 per cent., measured on a length of 8 ins., and should be capable of bending double without showing any sign of fracture.

In all cases test pieces are to be furnished inspectors whenever required.

ENGINEERING NEWS.

IN the River and Harbor Bill is a provision for the appointment of a board of three engineers of the United States army, who shall thoroughly examine and report upon the obstructions to navigation in the Columbia river, Oregon, at The Dalles and Celilo falls and at Three and Ten Mile rapids. This board is to report in December next upon the feasibility of constructing a boat-railway around the first two obstructions and of widening and improving the river channel at the other two. A bill is now before the Senate appropriating $500,000 for the ship railway. As described by Maj. W. A. JONES, U. S. Engs. in 1885, the length of track around the Celilo falls would be 4,500 ft., and the cost of track, trucks and machinery would be $356,000. The estimated cost of the Dalles transfer would be $662,000, with 9,000 ft. of track. To make these improvements available, about $355,000 would also have to be expended in rock excavation in the channel at other points, making a total of $1,373,000. The following is a brief description of the car and track proposed by Maj. JONES. The maximum grade of the track is 213.84 ft. per mile. The summit is passed by a gentle curve quite within the limits of longitudinal flexure that will result from passing over the summit curve. The car is made up of cross-girders supported by longitudinal built beams, which in turn are carried by the wheel axles, the whole suitably braced, and having sufficient iron introduced to prevent floating when completely submerged. It will be handled by cables from the stationary engine at the summit. It will have 21 wheels on each side with independent axles, 42 in all, running on a 2-rail track, 25 ft. 6 ins. wide. The maximum load on a single wheel will be about 17 tons. Length and width over all, 190 ft. and 48 ft., respectively. For the present only a single line of track is proposed. Should the traffic develop a necessity for it, another can be laid alongside."

The cylindrical steel crib for the Chicago lake tunnel, described in our issue of July 21, will, in all probability, be launched and floated into position sometime this month. The outer shell of the crib is made of steel plates ⅝ in. thick, 5 ft. wide and 8 ft. long. The steel plates used for the inner shell are ¼ in. thick, 5 ft. wide and 10 ft. long. Until Aug. 11, a force of 40 men had been steadily employed in the construction of the cylinders; at that time they were practically finished, and the force was reduced to the number needed to do the work of internal bracing. Four, or perhaps five scows will support the massive cylinder while it is towed into its position 2½ miles out in the lake. The method of launching will be similar to that employed in launching a boat.

THE London *Railway News* gives the official running time of the new Scotch Express on the East Coast route. The run of 392 miles to Edinburgh, is made with four stoppages only, viz., Grantham, 105 miles; York, 188; Newcastle, 272; Berwick, 339, and Edinburgh, 392 miles. The time is 8 hours less 7 minutes. The highest rates of speed per hour were, 58¾ miles for 44 miles run; 57¼ miles for 84 miles run, 56¾ miles for 18 miles run, 53½ miles for 67 miles run, etc. The average speed, including stoppages, was a small fraction over 49 miles per hour; and excluding stoppages, but including "slowing" and "starting", the average was 53½ miles per hour.

THE London *Standard* remarks as follows on the late railway race from London to Edinburgh: "The majority of people are just as likely to be frightened away from Euston as not by 75 miles an hour. A broken axle, a collision or upset, when such a train is going at full speed, would probably mean the death of every human being in it."

Death at 45 miles per hour, under similar conditions of "broken axle, collision or upset", would be quite as certain and uncomfortable.

CORRESPONDENCE.

Prevention of Pipe Freezing.

GUADALAJARA, Mexico, Aug. 14, 1888.

EDITOR ENGINEERING NEWS:

In answer to your correspondent G. F. C.'s inquiry in regard to protecting pipe from freezing in exposed positions, I will state that a provisional line of 12-in. pipe was laid across the Merrimac river, Lowell, before the construction of the 30-in. line which is laid under the river. The 12-in. pipe was laid through a covered bridge, without any packing, and in an unusually severe winter no trouble was experienced. The exposure was, as I recollect, for about 700 ft.

The following is a copy of specification for laying a line of 4-in. pipe which was under my charge as engineer in 1880, and the work has stood perfectly well. The location is Central Falls, R. I.: "wrought-iron steam pipe, 4 ins. diameter, and standard thickness, with screw joints, shall be laid over the bridges on Jenks and Cross Streets. It shall be protected with a felt wrapping 2 ins. in thickness, which wrapping shall be securely bound to the pipe, and afterwards thoroughly covered with stout canvas securely sewed on and coated with coal tar, and the whole boxed under such conditions as the engineer may direct." The span of the above bridge is about 75 ft. in each case. No taps were required to be kept running. Pressure about 100 lbs. per sq. in.

Yours truly,

C. H. M. BLAKE.

A London Water Party.

LONDON, Aug. 7, 1888.

EDITOR ENGINEERING NEWS:

Thinking that the doings of a late "water party on the Thames" might have some interest to your readers, for the professions represented and from the fact that American engineers and American machinery figured therein, I herewith send you a short detail of the "outing" referred to.

On a recent July morning a party of hydraulic engineers, builders of water-works machinery

professors in scientific and technical institutions and engineers eminent in other branches of the profession than that pertaining to water, boarded, at Hampton Court weir, a well equipped and handsome steam launch for a tour of inspection among various water-works on the upper Thames. With water on all sides of a party whose chief aim in life was the proper handling of water, by a singular oversight, there was a great scarcity of water among the miscellaneous stores provided by the commissary of the expedition. But, quite as singular, this omission passed unnoticed by the gallant company until later in the day when certain other substitutes therefor began to fail of their abundance.

Among the gentlemen making up this party of "Thames watermen" were at least some whose names are well known in both England and America to the profession of hydraulic engineers. We can mention A. T. SIMPSON, M. Inst. C. E., Vice Chairman of the long established London engineering firm of James Simpson & Co.; WM. A. PERRY, senior member of the firm of HENRY R. WORTHINGTON, who needs no introduction to your readers; J. G. MAIN, M. Inst. C. E. and M. Inst. M. E., also connected with the firm of James Simpson & Co. and who lately conducted an exhaustive test in the United States of the high duty pumping engine invented by the firm of HENRY R. WORTHINGTON, and to whose favorable report is due the rapid introduction of this American pump into England's works; W. J. BROWN, of the firm of James Simpson & Co.; S.H. SOUTTIT, Secretary Lambeth Water-Works; WM. MORRIS, M. Inst. C. E., M. Inst. M. E., Chief Engineer of the Kent Water-Works; E. L. MORRIS, M. Inst. C. E., M. Inst. M. E., Chief Engineer of the New River Water-Works; E. BERT Esq., Member of the Geological Survey of Great Britain; ED. A. COWPER, Past President Institute of Mechanical Engineers and Member of the Council Institution of Civil Engineers, who is well known in America as the inventor of the Cowper stoves for heating air in connection with blast furnaces; J. H. HARRIS, M. Inst. M. E., Assoc. M. Naval Architects and the General Manager of the Henry R. Worthington Pumping Engine Co. of London; W. C. UNWIN, Professor of Engineering, City Guilds, South Kensington, and well known to hydraulic engineers for his works on engineering and the flow of water through pipes; W. MATTHEWS, M. Inst. C. E., Chief Engineer Southampton Water-Works, G. EUNSON, Consulting Engineer, Northampton Water-Works, who is now having two high duty Worthington engines built for his company; M. ACKERMAN, M. Inst. M.E., Cape Town, Africa; C. PAGE, Esq. of the New River Water-Works; R. FOGG, Esq. of Cochran & Co., Middleborough; J. TAYLOR, M. Inst. C. E., M. Inst. M. E.. Engineer-in-chief of the Lambeth Water-Works; H. S. HOUGHTON, Assoc. M. Inst. C. E., M. Inst. M. E.; J. W. HOBBS, Assoc. M. Inst. C. E., M. Inst. M. E. and C. L. SIMPSON, of James Simpson & Co., who while he ends the list was nevertheless one of the most popular men in the expedition, for his admirable engineering of the solid and fluid creature comforts won universal applause.

This distinguished party of such a thoroughly hydraulic engineering stamp made their first stop to examine an American pumping engine which had only been started the day before at the Middlesex Water-Works. This machine was a twenty-nine million high duty Worthington pumping engine, pumping through a main about 18 miles long; and it was doing this work so steadily and quietly as to excite general and most favorable comment among these experts. This was the first engine with the peculiar high duty attachment that the majority of the party had ever seen, and the action of the compensating cylinders, doubling up at the beginning of the stroke only to straighten out at the end of it, suggested to some present the knees of an Oxford undergraduate putting in his work for the "Varsity" races.

The next stop was made at the Molesley Station of the Chelsea Water-Works, the latter being one of the largest of the six private companies supplying London with water. Here was found another Worthington high-duty pumping engine of about twenty-one million daily capacity. This engine had been in operation about 3 months pumping into a stand-pipe; and the "Yankee contrivance" was again voted a great success both by company officials and visiting experts.

At West Surrey, a smaller high duty Worthington engine was visited; and then the tourists returned to their steam launch to conduct an exhaustive test of individual "capacity" and individual "feed-pumps." This test was a supreme success and the celerity with which the solids and liquids disappeared would have awakened a sigh of envy in a region somewhere below the heart of DICKENS' fat boy JOE.

This enjoyable day in more senses than one was closed at Staines where, after a photograph of the whole party had been secured, the company was broken up by the departure of the American delegates for an early train on the Southwestern. The Americans in that excursion on England's most noted river will not soon forget the hearty English welcome of their host and his friends; and the pleasure of the occasion was not a little enhanced by the fact that this really distinguished party of England's professional men was gathered together solely to inspect the successful work of one of America's earliest and most eminent hydraulic engineers and that of his worthy successors.

Yours truly, H. D.

"Rock Fill Reservoir Dams."—A Reminiscence of the Cascade Bridge.

PORTLAND, Oregon, Aug. 5, 1888.

EDITOR ENGINEERING NEWS:

In your article of July 28, under the title above quoted, appears for illustration an imaginary account of work built to supersede the Cascade bridge on the Susquehanna Division of the New York and Erie Railroad, which it is well to put right while the interested parties are still on this planet.

The Cascade bridge was designed by JULIUS W. ADAMS, and built by the contractor JOHN FOWLER, and was in its day the longest wooden railroad span in existence.

The track grade was 175 ft. above the bottom of the gorge, which was about 50 ft. across and opened out as it ascended, so that the bridge, a circular segmental arch, measured 275 ft. in the clear between the skewbacks and 495 ft. on the hand rail.

This superstructure contained more than 444 M. b. m. of lumber, 66,000 lbs. of wrought iron, and 42,000 lbs. of castings, and was estimated to cost $45,550. What was its actual cost I am unable to say, though it was so much more than the original estimate that Mr. Fowler wished to surrender his contract and only persevered with it on the assurance of Messrs. BROWN and HORATIO ALLEN, the Chief and Consulting engineers of the line, that they would protect him against loss and allow him a fair margin of profit for his time in superintending the work.

I think I have fairly stated the facts concerning the monument to Mr. ADAMS' splendid genius, which was removed to make way for a permanent work. The General Superintendent of the road was D. C. MCCALLUM, a man of brilliant fame as a bridge builder before the day of iron bridges, who had been Superintendent of Bridges on the line under CHARLES MINAT, his predecessor as General Superintendent.

It has been said, though of this I have no certain knowledge, that if the Cascade bridge was out of the way, MCCALLUM could claim to have built the longest span wooden railroad bridge in the world.

In 1857 I was employed by Mr. MCCALLUM to make surveys and estimates and prepare plans for superseding the Cascade bridge with a permanent work.

I had been engaged eleven years in my profession; as a young man beginning life under E. S. CHESBROUGH, T. E. SICKELS and THOMAS DOANE and later as a resident engineer on the B. & O. R. R. under BENJ. H. LATROBE, and as a division engineer under JAMES P. KIRKWOOD. At the time Mr. MCCALLUM called me I was a writer on the *American Railroad Journal*, where I had succeeded ZERAH COLBURN as an assistant to HENRY V. POOR.

My work at the Cascade was done in counsel with Mr. HUGH RIDDLE, Div. Supt. of the Susquehanna division, a prominent civil engineer, who has, I think, been a member of the Am. Soc. C. E.

Mr. RIDDLE will justify me in saying that while the Cascade bridge was a magnificent structure, it would have been as appropriate in Central Park as over that ravine. You are mistaken in saying "the place was an awkward one for masons to get at and work in". On the contrary, it would have been a very simple affair to put an arch there or do just what has been done. That it was necessary to put a bridge did not seem to us to admit of discussion. This is all I have to say of "the original engineering staff who showed such excellent judgment and skill" in erecting a bridge of 275 ft. in a single span over a stream 12 ft. wide and less than 3 ft. deep, in the building season; in a dry gorge with firm rock banks and in a country crowded full of timber.

Nor would an iron trestle or truss be more justifiable than the wooden bridge, since it is not a permanent structure and the vicinity of rock made a permanent work practicable at light cost.

Here, it is proper to say that after Mr. MCCALLUM told me what he wanted he never again meddled with the work and I never saw him there; my duties being all done as before stated in consulta- with a civil engineer, Mr. HUGH RIDDLE.

A careful topographical survey was made and then various plans of solving the problem were discussed.

An arch in the bottom was estimated; an arch on a rock bank was also considered; but after a comparison of estimates, it was found that rock being close at hand in abundance; labor cheap, only 75 cts. and 87 cts. per day, and a rock bank costing but from 30 cts to 40 cts. per cu. yd., it would be expedient to put up the rock bank, which would carry off the water of the dry season and put a culvert on top at the point where it was deemed proper to begin the earth work. This plan was modified by a tunnel instead, to serve as a waster when floods came.

The work has done just what it was designed to do. The bank as a blind drain, carries off the ordinary flow of water, and when a flood comes it is wasted by the tunnel or gallery under the bank. There is no possible objection to damming up the water above the embankment, since no depth can possibly move it and the gorge is not available for any class of improvements save, perhaps, an expensive work to show what our profession can do when it has a good chance.

The story of "driving a tunnel in hot haste behind and around the fill", is incorrect. I was not connected with the construction, but the tunnel, as cheaper than a structure in masonry, was part of the original design. I think it very likely there was a hope that the rock fill would carry off all the water and when it was seen that it would not, the gallery was opened after its necessity had been proven by experience.

You have not therefore to "hunt up names to bear the burdens of a failure"; the names you have, and since the work has done all that was claimed of it, what more will you?

As a design in architecture, a poverty stricken railroad company can hardly ask better than to be hidden in a hemlock glen. The whole work cost less than $50,000. I think the figures were $35,000, but I cannot be positive on this subject.

The Dutchman's table was "not pretty for handsome, but was hell for strong"; this may justly be the engineer's comment on the Cascade embankment.

ALFRED F. SEARS,
M. Am. Soc. C. E.

[As we shall very shortly publish a full description of the Cascade bridge, giving in detail the reasons for locating it at that point, and for the plan of the original structure, we will leave that paper to answer the several points raised in our correspondent's interesting letter.—ED. ENG. NEWS].

SOCIETY PROCEEDINGS.

New England Water-Works Association.—The regular quarterly meeting of this Association will be held at Cambridge, Mass., on Wednesday, Sept. 12th. Members and guests will report at Union Hall, Main St. Cambridgeport, Mass., at 9 A. M., where they will be received by a committee of the City Government and Water Board.

At 9.15 A. M., a short business meeting will be held.

At 9.30 A. M., carriages will be taken for a drive through the city, and a short stop will be made at Harvard University, after which the party will be taken around the shores of Fresh Pond storage basin, and will arrive at the pumping station at 11 o'clock A. M.

A lunch will be served at this place and ample opportunity offered for the inspection of the pumping machinery.

The party will leave the pumping station at 12 o'clock M. by a special train for an inspection of the recently completed Stony Brook storage reservoir. Returning, they will arrive at North Cambridge station at 2 o'clock P. M., at which place they will be transferred to horse cars and conveyed to Union Hall, where a complimentary dinner will be tendered the Association by the City Government at 3 o'clock P. M.

As far as practicable it is desired that members be accompanied by representatives of their Water Boards.

All those who are eligible for membership, and who have not already joined the Association, are cordially invited to do so. Application blanks may be obtained of the Secretary, who would be pleased to correspond with any parties desiring information on this point.

HIRAM NEVONS, *President*, Cambridge, Mass. R. C. P. COGGESHALL, *Secretary*, New Bedford, Mass.

CONSTRUCTION NEWS.

RAILROADS.

East of Chicago.

Existing Roads.

Philadelphia & Reading.—Contracts are to be let soon for completing the double tracking of the East Pennsylvania Railroad between Reading and Allentown, Pa. About 16 miles of the line are still single track. Construction is in progress on a branch road to run from Lebanon furnaces to Avon.——No work is at present in progress along the new Philadelphia terminals. Some seven or eight buildings have been demolished at different points on the line, but nothing further has been done. In reference to the abolition of grade crossings, one of the officers of the company is quoted as follows by the Philadelphia *Press:*

"The road we wanted to build, preserving the surface tracks, or the 'double-deck road', as its enemies call it, would have cost about $400,000 or $500,000 a mile to build, above Green Street. The elevation of the surface tracks would cost an incalculable sum—four tracks at least, all the way, sidings and yards along it to accommodate the freight traffic of the industries that have grown up alongside the road, and so on. I know some yards which it would cost $250,000 to accommodate to an elevated structure. That is why it is impossible for us to do it without help from the city. It will entail enough greater cost on us if the city were to build the four elevated tracks.

"Now it seems for the present needs of the city for rapid transit, that it would be only the part of wisdom for the city to give us what we ask—to allow the extension to be built, and then, if we can't have our cheaper and more convenient 'double-deck' road, when from time to time someone, the city, for instance, or the Traction Company, perhaps, is willing to help us abolish some grade crossings, this evil, which we appreciate as much as anybody, will be quickly done away with, without disturbance of business and with proportionate benefit to the city at large."

Pennsylvania.—The story that the company proposed to build a line to parallel the South Penn. seems to have had very slight foundation.——The company has brought suit against the owners of the Arthur Kill bridge to recover damages to the amount of $5,210,000. The claim is set up that the bridge is such a hindrance to navigation that the cost of towing has been doubled; also that many boats have suffered damage by collision with the abutments and piers of the bridge. The branch from the Central Railroad of New Jersey to the bridge is to be completed this season. It is about 6 miles in length.

New Jersey & New York.—It is proposed to extend this New Jersey line south to a connection with the Central Railroad of New Jersey and north to the terminus of the proposed Peekskill bridge.

Baltimore & Drum Point.—The suit between the company and the county commissioners of Calvert county, Md., has been satisfactorily adjusted and the company is to receive its subsidy at once.

Niagara Central.—This company, which is building a railway from Niagara Falls, to Toronto, Ont., wishes to secure an entrance to Buffalo, N. Y., and it is proposed to build another bridge across the river at Grand Island. It is thought likely that this road will eventually come into the hands of the Canadian Pacific, in which event the extension to Buffalo would certainly be made.

St. Louis, Sturgis & Battle Creek.—Sub-contracts have been let by J. J., Burns & Co., of Battle Creek, Mich., on the 15 miles between Athens and Battle Creek to Mitchell Bros., John Gahell, McGavock Bros., M. T. Lally and Nevell & Ryan. The 12 miles from Goshen, Ind., east, has been let to David Siske & Co.

Kilkenny.—This lumber road in northern New Hampshire is considering an extension to a connection with the Grand Trunk. The line is a rival to the Whitefield & Jefferson, reported last week.

Delaware, Lackawanna & Western.—The common stock of this company has risen from 120 to 144 within the past two months. It is rumored that the rise is due to buying by the GOULDS, who are said to have quietly secured about 70,000 shares of the stock. President SLOAN is expected home from his trip abroad on Sept. 5; and it is expected that he will bring news of the successful floating of the Winona & Southwestern bonds, an enterprise in which the Lackawanna managers are heavily interested.

Port Jervis, Monticello & New York.—The 18 mile branch from Huguenot to Summitville, N. Y., is graded and will soon be laid with rails. The Union Bridge Company have the contract for a 350 ft. bridge over the Neversink river at Cuddebackville, to be finished by Dec. 1.

Lake Erie, Essex & Detroit River.—Tracklaying is in progress at the rate of a mile a day on this road in western Ontario, JOHN MCAFEE, Harrow, Ont., is Chief Engineer.

New Projects and Surveys.

North Attleboro & Wrentham.—This is the name adopted for this new Massachusetts enterprise, reported last week. At the meeting held by the projectors on Aug. 23, the following were chosen directors: J. D. LINCOLN, D. H. COREY, H. E. THOMPSON, Plainville; DAN. BROWN, H. A. COWELL, A. F. BENNETT, Wrentham; T. I. SMITH, CHAS. T. GUILD, A. E. CODDING, E. I. RICHARDS, and F. M. WHITING, North Attleboro. Enough stock has been subscribed to ensure the building of the line. The charter is to be applied for at once. The Old Colony has offerred to lease the new line at 7 per cent. on its cost and build a line from Dedham to Walpole to give a direct outlet.

Deer Creek & Susquehanna.—Work on the surveys and the securing of the right of way for this Maryland road is making good progress. Several routes are being surveyed for an entrance to Belair. D. E. Miller & Co. of Baltimore have the contract for building the line.

Baltimore & Eastern Shore.—It is reported that capital has been secured for the construction of this Maryland road and that contracts are to be let at once. JOS. B. SETH, Easton, Md., is President and W. H. LECHELBERGER is Chief Engineer.

Detroit, Charlevoix & Escanaba.—This Michigan line has asked financial aid from Lake City, Missaukee County.

Chicago, Dayton & Cincinnati.—Wabash and Hartford townships in Indiana have voted on the proposed subsidy to this road.

Evansville, Ft. Wayne & Chicago.—The survey of this line, which is to follow the towpath of the old Wabash & Erie canal from Ft. Wayne to Lafayette has been completed, and it is estimated that the line can be graded for $300 per mile. The distance is 109 miles. JAS. DREW of Indianapolis is interested.

Cleveland, Chagrin Falls & Southern.—This line is rojected to run from Cleveland to Chagrin Falls, Ohio. J. H. WARDWELL of Cleveland is President, and H. A. KENNEDY is Chief Engineer. The line is in the interest of the Cleveland & Canton.

Mendham.—This New Jersey company has been organized with A. REASONER, President; WM. HALSTEAD of the Delaware, Lackawanna & Western, H. C. PITNEY of Morristown and Dr. STIGER of Mendham as directors. The final location is now in progress. The line is to be 9 miles in length.

SOUTHERN

Existing Roads.

Maysville & Big Sandy.—On the morning of Aug. 26 the channel span of the bridge across the Ohio river at Cincinnati, O., was carried away by the flood. Further particulars are given on another page. The accident may delay the final completion of the line and the entrance of trains into Cincinnati some weeks.

Northwest & Florida.—A stockholder's meeting was held at Montgomery, Ala., on Aug. 30 to ratify the proposed issue of $1,800,000 of first mortgage bonds, and $9,000,000 of income bonds to retire the outstanding securities and secure capital for the extension of the road.

Chattanooga, Rome & Columbus.—The Atlanta *Constitution* publishes an interview with an officer of this company in which it is stated that one of the possibilities of the future is a branch from Carrollton to Atlanta. It is not thought, however, that the branch will be seriously considered until after the Columbus extension is completed.

Richmond & Danville.—The gauge of the Franklin Branch of the Virginia Midland division has been altered to standard. The line is 37 miles in length.

Farmville & Powhatan.—About 40 miles have been graded on this Virginia road, and tracklaying is to begin as soon as the remaining 24 miles are ready. The town of Farmville has voted $50,000 in aid of the enterprise.

Atlanta & Florida.—The city of Brunswick, Ga., is making offers to secure the southern extension from Fort Valley, and Thomasville is also anxious to secure the line.——It is prophesied that the road will eventually become a part of the Richmond & Danville system.

Central Railroad of Georgia.—The Cincinnati, Selma & Mobile, a controlling interest in which was recently secured by the Central system, will probably be extended from Akron, Ala., to Aberdeen, Miss. About 14 miles were graded when the road was in the hands of the former company. The remaining 68 miles are through a country favorable for rapid and cheap construction. The main items of expense would be the bridges across the Black Warrior and Lipsey rivers.

Charleston, Cincinnati & Chicago.—The opening of the line to Rock Hill, S. C., was celebrated at that city on Thursday, Aug. 23, delegations being present from Charleston, Lancaster, Camden and other points. The tracklayers have just reached Yorkville, 12 miles northwest from Rock Hill.

Rome & Decatur.—The construction force has been transferred from the division just completed to the division between Atalla and Decatur, Ala., which is to be pushed forward at once.

Augusta, Gibson & Sandersville.—A subscription is being raised at Tenille, Ga., to induce the extension of the line to that point.

Southern & Western Air Line.—The force now engaged in grading this North Carolina road is to be increased. J. W. WILSON, Morgantown, N. C., is Chief Engineer.

New Projects and Surveys.

Union City, Louisville & Memphis.—A charter has been asked for this Tennessee company which proposes to build a railroad from Union City to Reeves on the Mobile & Ohio and thence to Harris Station on the Newport News & Mississippi Valley railroad. W. R. GARDNER and W. H. GRIFFIN of Union City are interested.

Dayton & Faunsdale.—Sealed proposals are asked for grading this line from Dayton to Faunsdale, Ala., 8¼ miles, and will be received until Sept. 11 by the President, R. W. PRICE of Dayton, Ala. Bids may be made for the whole or for any part of the work not less than one mile.

Decatur, Chesapeake & New Orleans.—This company has filed its charter in Alabama for the portion of its line within that State. The capital stock is $200,000.

Hawkinsville, Americus & Eastern.—This company, whose headquarters are at Hawkinsville, Ga., has elected J. D STETSON, President; R. J. TAYLOR, Vice President and R. G. LEWIS, Secretary and Treasurer. Work on the line is reported in progress.

Gainesville & Worthington.—A railroad is projected, from Gainesville to Worthington, Ala., about 18 miles.

Genesis & Obed River.—This line is projected to run from near Crossville, Tenn., *via* Genesis to a connection with the Cincinnati Southern Railroad, about 15 miles. J. B. HOLMES, Genesis, Tenn., is Chief Engineer. The surveys are completed and contracts will be let Oct. 1.

Atlantic, Gulf & Havana.—Incorporated at St. Augustine, Fla., to build a railway from St. Augustine to Tampa *via* De Land.

Eastern, Barnwell & Western.—This company, fully reported in ENGINEERING NEWS of March, 10, 1888, has organized and elected W. H. DUNCAN, Barnwell, S. C., President.

Memphis & Atlantic.—The Memphis, Oxford & Columbus companies of Alabama and Mississippi, and the Memphis, Tuskaloosa & Atlantic company have been consolidated as the Memphis & Atlantic company. Major BELTON MICKLE is Chief Engineer. The surveys have been completed from Columbus to West Point, Miss., and are now in progress beyond West Point. The whole line is to extend from Memphis, Tenn., to Tuscaloosa, Ala., 260 miles. Contracts are to be let soon, according to report.

THE NORTHWEST.

Existing Roads.

Chicago, Burlington & Northern.—This company has just filed a new mortgage to secure the payment of $940,000 in bonds, the property mortgaged being 15 engines and 1,500 cars. The bonds are due in 15 years and bear 7 per cent. interest. A new second mortgage on the road itself, at the rate of $10,000 per mile, has just been offered to the stockholders at 80, the bonds bearing 7 per cent. interest. This makes the total capitalization of the company $60,000 per mile, on which the interest charges are about $700,000 per annum. The total net deficit since the opening of the road in 1886 has been about $900,000, due largely to the fact that the company has been engaged most of the time in a sharp battle for the competitive through traffic between Chicago and St. Paul. It has succeeded in keeping rates down to a ridiculously low figure and in whittling down the earnings of its competitors; but in so doing it has been playing an expensive game, and one which it cannot much longer continue. It will be recalled that it was the warfare of this company that recently led the managers of the Chicago, St. Paul & Kansas City to deliberately disregard the long and short haul clause of the Interstate Commerce law and declare in defense that this competitor was doing business at less than its actual cost. The financial showing of the company seems to fully bear out this charge.

Manitoba.—The railway situation at Winnipeg is growing more and more complicated. Messrs. KENDRICK and MCNAUGHT, of the Northern Pacific have accepted the modifications of the original contract. Under the former contract the government was to retain $4,000 bonds per mile out of an issue of $16,000, those not to be issued until it was demonstrated to the satisfaction of the commission that it was necessary for the completion of the road. It is now agreed that the commissioners' certificate of necessity will be required for all expenditures over $8,000 per mile, and it is definitely understood that this issue will be an absolute first mortgage on the road. The Manitoba legislature was assembled in extraordinary session on Aug. 28, to ratify the contract of the Government with the Northern Pacific. Under the terms of the

contract as reported, the company agrees to grant trackage rights over the Red River Valley Railway to all other roads except the St. Paul, Minneapolis & Manitoba, the only line which is at present near enough to the boundary to be able to run over the Red River Valley road within a reasonable time. W. P. CLOUGH, Vice President of the St. Paul, Minneapolis & Manitoba, arrived in Winnipeg just after the assembling of the legislature, prepared to offer on behalf of his company a contract claimed to be superior to that of the Northern Pacific. The popular sentiment, it is stated, was turned at once in favor of a refusal of the Northern Pacific contract and the ratification of a new one with the Manitoba company; but there is a large party still in favor of supporting the Government. Premier GREENWAY is quoted as saying, "with such certainties as are promised it is very improbable that representatives of the people of Manitoba, who for long years have been seeking relief from railroad monopoly and high transportation, will be willing to incur the responsibility of refusing to ratify the agreement and thereby give up a certainty for an uncertainty."

Duluth, South Shore & Atlantic.—The first through passenger train over the western extension of the Duluth, South Shore & Atlantic reached Duluth, Minn., on Aug. 23, carrying President JAS. MCMILLAN; SAMUEL THOMAS and GEO. I. SENEY of New York City; W. C. VAN HORNE, the new Vice-President; J. A. LATCHA, Chief Engineer, and others. The train ran over the South Shore tracks as far as Iron River, where it was transferred to the Northern Pacific line. Henry & Balch, the contractors at work on the extension to West Superior, have been ordered to stop work, and it is announced that a contract has finally been made for the use of the Northern Pacific's tracks from Iron River junction to West Superior at a rental of 6 per cent. on half the valuation. The contractors are transferring their equipment to the Gogebic branch, which is to run to Bessemer, Ironwood and Hurley, and it will be pushed to completion at once. The survey is in progress for a branch to the copper regions, running from Houghton to Calumet.

Chicago & Indiana Coal.—On the extension from Momence, Ill., to Goodland, Ind., about 20 miles of track have been laid, and the 12 miles remaining are expected to be finished so that the road can be open for traffic by Sept. 15.

Minneapolis, St Paul & Sault Ste. Marie.—The citizens of Rice Lake, Wis., are trying to induce the company to build a branch to that point.

New Projects and Surveys.

Nebraska Southern.—It is reported that surveys have been made from Red Cloud, Neb., *via* Minden, to a point on the Platte river, opposite Kearney, a distance of about 60 miles. C. H. SWIGART, Superior, Neb., is Chief Engineer.

Sioux Falls, De Smet & Northern.—The surveyors on this Dakota road have reached Groton.

St. Paul, Black Hills & Pacific.—The survey in progress from Mandan, Dak., to the Black Hills, is in the interest of this company and not of the Northern Pacific as reported last week. L. G. JOHNSON, Aberdeen, Dak., is General Manager.

THE SOUTHWEST.

Existing Roads.

Missouri, Kansas & Texas.—The report of the investigating committee which was set at work in June last to examine the affairs of this company on behalf of the bondholders has just been made public. The report states that the whole system requires extensive repairs which will require an expenditure of $3,015,000 on the Missouri, Kansas & Texas proper, and $1,722,000 on the International & Great Northern, making a total of $4,337,000 required for immediate repairs. The report states "that there is a seeming deficit of over $3,000,000, as an offset to which the company owns certain valuable assets, as appears by schedule, together with an equity in the adjustment of charges made against the Missouri, Kansas & Texas Railway arising from losses of operation, division of business, and operation of the Holden branch."

The Missouri, Kansas & Texas is reported to have suffered serious losses through the operation of the International & Great Northern. The equitable rights of the former were ignored by its lessor, the Missouri Pacific. The International & Great Northern business, it is affirmed, "has been so divided that the Missouri, Kansas & Texas has received but 30 per cent. of it, and the remaining 70 per cent. has been diverted to other portions of the system and to the benefit of other properties. The committee regrets that it had no opportunity to investigate the accounts of the Missouri Pacific, the lessor road. Charges of millions of dollars entered against the Missouri, Kansas & Texas Road are declared to have been liabilities of the Missouri Pacific. As to the separation of the Missouri, Kansas & Texas from the Missouri Pacific, no suggestion is made by the committee, though it is intimated that the former would suffer less comparatively in competition than would the richer corporation, the Missouri Pacific.

Chicago, St. Paul & Kansas City.—It is announced that the extension of this line from St. Joseph to Kansas City, will probably be postponed until next season on account of the delays occasioned by the difficulty in obtaining the desired entrance to St. Joseph.

Dodge City, Montezuma & Trinidad.—The first train on this line reached Montezuma, 27 miles west of Dodge City, Kan., on Aug. 24.

Cleveland, St. Louis & Kansas City.—According to the New York *World*, among the capitalists now interested in this line are JAS. ROOSEVELT, JOHN D. VERMEULE, FRANK C. HOLLINS, ROBERT B. ROOSEVELT and LOUIS L. LORILLARD, of New York City. It says in relation to the enterprise:

"The road has acquired all the rights and franchises of the Central Missouri company, including a franchise from Congress for a low bridge across the Mississippi river at Alton, Ill., about 20 miles north of St. Louis, and for two bridges over the Missouri river, one at St. Charles and the other at Arrow Rock, Mo. The price paid for the property was $600,000.

"The great feature of this enterprise is the bridge across the Mississippi river at Alton, Ill., 20 miles north of St. Louis. By this bridge the heavy bridge and terminal charges levied on all passengers and freight entering St. Louis would be saved, and all through business to points east and west of the Mississippi river would be made independent of St. Louis and the Gould bridge, and thus be the key to the situation in the Southwest. The cost of the Alton bridge will not exceed $2,000,000 as against a capitalization of $14,224,000 of the St. Louis Bridge & Terminal Company. The new road is located from Alton through ten of the richest counties in the State of Missouri to Kansas City, which is nearly an air line west from Alton."

New Projects and Surveys.

Memphis, Little Rock & Indian Territory.—A survey of this Arkansas road has been made from Little Rock to Hot Springs.

St. Louis, Baxter Springs & Oklahoma.—The general offices of this company, reported last week, are at Baxter Springs, Kan. Among the incorporators are J. C. MURDOCK, Galena; H. HORNER, Baxter Springs; CHAS. M. ALEXANDER and PATRICK HARRISON of St. Louis, and ALEX. WARNER of Pomfret, Ct.

Kansas City & Bonner Springs Rapid Transit.—President W. A. SIMPSON, and other officers of this Kansas City company are negotiating with M. W. LANPHERE of Des Moines, Ia., for the construction of the line.

Concho Valley.—This company has been organized at San Angelo, Tex., with a capital stock of $25,000. F. B. MALONE, Dallas, Tex., is interested.

ROCKY MOUNTAIN & PACIFIC.

Existing Roads.

Northern Pacific.—There is some prospect that the company will secure from the Montana Central company a trackage right through the Wickes tunnel, when it is open for traffic.—The earnings of the company are the wonder of Wall Street this year, showing constant increases of about one-third.—The decision will probably soon be made on the permanency of the court injunction suspending operations on the construction by the Oregon Ry. & Nav. Co. of branches in Idaho and eastern Washington Territory competing with the Northern Pacific.

St. Paul, Minneapolis & Manitoba.—It is reported that the surveyors locating the extension of the Sand Coulee branch in Montana are working in the direction of the Judith basin.

Oregon & Washington Territory.—On this line which is under construction from Wallula to Walla Walla, W. T., *via* Eureka Flat, grading is completed to within six miles of Walla Walla, and 25 miles of track have been laid, leaving 24 miles still to lay. About 500 men are at work on the line. It is expected that the whole road will be finished by Oct. 1. Ballasting is in progress on the Wallula and Centerville line, 35 miles in length, on which tracklaying was recently completed. G. W. HUNT of Portland, Ore., is the builder of the lines.

Oregon Ry. & Nav. Co.—Tracklaying is completed on the Riparia branch, and the Cœur d' Alene extension is expected to reach Rockford by Sept. 20, and Spokane Falls, 25 miles farther, by Dec. 1.

Portland & Vancouver.—This suburban motor line at Portland, Ore., has just completed its tracklaying and will begin operations by Sept. 15. Branches are contemplated next spring to St. John's and to a connection with the Oregon Ry. & Nav. Co.

Southern Pacific.—It is reported that 3,000 Chinese laborers are to be set at work at once upon the Vaca Valley & Clear Lake extension from Rumsey to Clear Lake, Cal., about 25 miles.

Nevada & California.—It is reported that this company has been aroused by the activity of the Northern California company, and that they have secured the right of way for and begun the construction of a branch line to Quincy, Plumas county, Cal.

Oregon Pacific.—Additional contracts have been let to Jas. J. Searle and E. B. Deane of California, 15 miles. Also to Job & Neugass of Corvallis, the 10 mile section next east of the above. Vice President HOAG states that the company expects to finish the work to the summit of the range this fall.

New Projects and Surveys.

Astoria & South Coast.—About $60,000 has been subscribed to this company recently organized at Astoria, Ore. Surveys are to be made at once and bids will be asked for building the road. Besides the projectors named last week, Hon. FRANK J. TAYLOR, C. W. FULTON D. K. WARREN and JOHN A. DEVLIN are interested.

Spokane Falls & Southern.—The projectors of this Washington Territory company are said to be negotiating for aid from the Canadian Pacific.

Proposals Open.

Harbor.—Improvement of the harbor of Rio Grande do Sul. THE CONSUL-GENERAL OF BRAZIL, 24 State St. New York City.

Artesian Well.—LOCK BOX 18, Ladonia, Tex.

Bridge.—Iron bridge over the Little Kanawha; 300 ft. long. THE COUNTY COMMISSIONERS, Parkersburg, W. Va.

Bridge.—Substructure and superstructure for rebuilding the Wabasha St. bridge. THE CITY CLERK, St. Paul, Minn.

Viaduct.—HAWK ST. VIADUCT COMMISSIONERS, Albany, N. Y.

Pumping Machinery.—At auction. For sale at River Ave. pumping station; two pumping engines, 4 steam cylinders, 8-ft. stroke, spring packing composition metal rings, poppet valves operated by Hartupee's patent lifters, cast-iron bed-plates, fly-wheels and shafts, wrought-iron cranks, four double-acting piston pumps with chambers, air vessels and all necessary valves, connecting links to pump-rods of wrought-iron; fly wheels, about 7 tons; the whole plant as now operated by the city. Further information at the office of EDWARD ARMSTRONG, Superintendent of Water-Works, City Hall, Allegheny, Pa. Sale September 3.

Water-Works.—At Monmouth, Ill. About 2½ miles of pipe; valves and hydrants; 400,000 galls. reservoir; wooden tank on iron tower 100 ft. high. Engineers, LOWETH & CURTIS, Drake Block, St. Paul, Minn. W. W. MCCULLOUGH, Chairman, Water Committee, Monmouth, Ill. September 3.

Street Work, Sewers and Broken Stone.—H. W. BANNISTER, City Clerk, Syracuse, N. Y. September 3.

Sewers.—Vitrified pipe, 15 and 12-in.; manholes and basins. ERNEST ADAM, City Surveyor, Newark, N. J. September 4.

Sewers.—WM. C. HOLLIDAY, City Engineer, Clinton, Mo. September 4.

Building.—Superstructure of Western Pennsylvania Exposition building. JOSEPH STILLBURG, Architect, 20 Fifth Ave., Pittsburg, Pa. September 7.

Water-Works.—Brick pump well, 15 ft. diameter, 23 ft. deep; collecting gallery of 2 lines of 15-in perforated tile pipe laid in trench 13 ft. deep; reservoir; laying 42,200 ft. of 6, 8, 10, 12, 14 and 16-in. pipe, with specials, valves and 62 hydrants. THE WATEROUS ENGINE WORKS, Brantford, Ont., Canada. September 8.

Water-Works.—Laying about 1,000 tons of 4, 6, 8 and 10-in. cast-iron pipe and appurtenances; 250 tons before Dec. 1, the remainder before June 1. T. H. MCKENZIE, Engineer, Naugatuck Water Co., Naugatuck, Conn. September 8.

Street Work.—J. P. ADAMS, Commissioner of City Works, Brooklyn, N. Y. September 10.

Pipe.—About 764 ft. of 6-in. and 8,470 ft. of 4-in. cast-iron water pipe: 5,070 ft. of 1-in. and 2,220 ft. of ¾-in. wrought-iron galvanized pipe; 23 fire hydrants and other fittings. Separate bids for material and laying will be received. Capt. L. E. CAMPBELL, U. S. A., Denver, Col. September 11.

Electric Light Plant.—For penitentiary. The plant to be of sufficient capacity to maintain not less than 480 incandescent lights of 16 c. p. each, and the engine and boiler for same to be of not less than 50 H. P.; the dynamo to be compound, wound for maintaining automatically a constant pressure on the lamps. Bids to be accompanied by the plans and specifications according to which the bidder proposes to construct the plant. Each bidder will also furnish catalogue of lamps, with price of each, so the Commissioners can select each lamp; all to be completed entire by November 1, 1888. J. E. EDMISTON, Secretary, Board of Penitentiary Commissioners, Walla Walla, Wash. Ty. September 11.

Railway.—Grading about 8½ miles. R. W. PRICE, President, Dayton & Faunsdale R. R., Dayton, Ala. September 11.

Lock House—At Lock No. 7, Great Kanawha river improvement. Col. WM. P. CRAIGHILL, U. S. Engineer Office, Charleston, W. Va. September 12.

Street Work.—Macadamizing, guttering, curbing and brick sidewalk. THE CITY ENGINEER, Roanoke, Va. September 13.

Freight Shed.—Iron freight shed, 67×132 ft. Architects, PETERS & BURNS, Dayton, O. J. B. THOMAS, National Military Home, Dayton, O. September 14.

Coil Boilers.—For coast defence vessels. THE SECRETARY OF THE NAVY, Washington, D. C. September 15.

Levees.—Raleigh, 250,000 cu. yds.; Hard Times Wilson, 350,000 cu. yds. F. L. MAXWELL, President, Board of Commissioners for 5th Levee District, Tallulah, La. September 17.

Sewers.—Furnishing and laying 7,000 ft. of 24-in., 3,000 ft. of 12-in., 3,500 ft. of 8-in. sewer pipe, and 25 manholes, THE CITY ENGINEER, Roanoke, Va. Sept. 18.

Dredging and Mattress Work.—Dredging and excavating rock from the channel to James river, near

Richmond, Va.; the construction of mattress-dikes; and the construction and extension of jetties. Col. WM. P. CRAIGHILL, U. S. Engineer Office, Richmond, Va. Sept. 18.

Water-Works.—Pumping station; supply wells and connections; stand-pipe, 25 ft. diameter and 80 ft. high; pumping machinery; mechanical filters, and approximately 5,000 ft. of 8 to 14-in. cast-iron pipe, with the necessary special castings; also, five 12-in., four 4-in. and four 8-in. stop valves. The machinery to consist of two engines, with boilers; one set to have a daily capacity of 1,000,000 and one of 1,500,000 galls. per 24 hours. The filter plant to have a daily capacity of 500,000 galls. Proposals for entire work or parts. GEO. HORNUNG, Sidney, O., Consulting Engineer. JOHN HEISER, President, Water-Works Trustees, Sidney, O. Sept. 18.

Jetty.—Stone jetty at mouth of Galveston harbor. Maj. O. H. ERNST, U. S. Engineer Office, Galveston, Tex. Sept. 20.

Buildings.—Keepers' dwellings at Locks 3, 4 and 5, Kentucky river. Capt. D. W. LOCKWOOD, U. S. Engineer Office, Cincinnati, O. Sept. 20.

Dredging.—In the ship channel at Baltimore. Col. WM. P. CRAIGHILL, U. S. Engineer Office, Baltimore, Md. Sept. 21.

Sewerage and Drainage.—Lieut. E. B. PRATT, U.S.A., Fort Mackinac, Mich. Sept. 22.

Contracting.

Pumping Engine.—The following proposals for a pumping engine, with a daily capacity of 5,000,000 galls., were opened Aug. 27, by the Board of Public Works, Jersey City, N. J. M. T. Davidson, triple expansion engine, $18,000; H. R. Worthington, $30,500; Shapley & Wells, $32,300.

Dredging.—The following proposals for dredging about 140,000 cu. yds. of material in the Albany basin, were opened Aug. 29 by JAMES SHANAHAN, Superintendent of Public Works, Albany, N. Y.: John Van Patten & Co., of West Troy, N. Y., 24¼ cts. per cu. yd.; Thos. Potter, Jersey City, N. Y., 27½ cts.; E. M. Payn, Albany, N. Y., 38 cts. The contract was awarded to John Van Patten & Co.

Asphalt Paving.—The following was the only proposal received Aug. 21, by Col. JOHN M. WILSON, U. S. A., Office of Public Buildings & Grounds, War Department, Washington, D. C.: H. L. Cranford, Washington, D. C.; $1.35 per sq. yd. for 1,800 sq. yds. of Trinidad asphaltum for asphalt footwalks; no bid for Vorwohler or Neuchatel mastic for asphalt sidewalks and no bid for 2,000 sq. yds. of asphalt street pavement.

Dam.—The following proposals for a rubble stone dam with cut stone facing, on Whiting St. brook, above the present water-works, containing about 8,000 perches, have been received by the Water Commissioners, Holyoke, Mass.: Delaney Bros., Holyoke, rubble masonry including coping of stone 7 ft. long and 6 to 8 ins. thick, $4.49 per perch; G. L. Bosworth & Co., Holyoke, rubble masonry, $4.49 per perch; coping, 30 cts. per sq. ft.; Michael O'Connor, Holyoke, rubble masonry, including coping of stone, $4.65 per perch; Geo. M. Atkins & Co., Palmer, Mass., rubble masonry, $4.35 per perch; Geo. W. Hendricks, Easthampton, Mass., rubble masonry, $6 per perch; Edson M. Fiske, Huntington, Mass., rubble masonry, $4.80 per perch; coping, $15 per perch. The contract was awarded to Delaney Bros., at $4.49 per perch for the entire work.

Sewers.—*Lowell, Mass.*—The contract for building the Powell St. sewer has been awarded to James Slavin at $2,200.

Providence, R. I.—City Engineer GRAY has awarded the contract for a sewer on W. Exchange St. to John Keogh, at the following prices, the materials being supplied by the city: 28-in. x 42-in. brick sewer, $3 per lin. ft.; 38-in. x 57-in. brick sewer, $4; laying 12-in. pipe sewer, $1.25 per lin. ft.; laying 8-in. pipe in various connections, 80 cts. per lin. ft.; setting 12-in., 8-in. and 6-in. connections, 25 cts., 12 cts. and 10 cts. each; building catch basins, complete, $16 each; manholes, $18 each; extra inlets, $12 each.

Philadelphia, Pa.—LOUIS WAGNER, Director of Public Works, opened proposals last week for the construction of 21 branch sewers, for which there were 26 competitors, with individual bids in almost every case. They were scheduled according to custom, and the contracts will be awarded at an early date by the Director. The figures ran from $3.40 as the highest price per lineal foot, to the lowest at $1.94, the difference in the sums offered varying according to the hardness, the possible rock and other conditions of the ground to be excavated.

St. Louis, Mo.—The following were the lowest proposals for constructing sewers, received recently by the Board of Public Works: Phillip Uridge, $3.24 per lin. ft.; John Affeld, $2.35; R. J. Zander, $1.65.

City Work.—*Kansas City, Mo.*—The Public Improvements Committee has awarded contracts at the following prices: grading, 12 to 38 cts. for earth and 50 cts. for rock; curbing, 24 to 67 cts.; 5 ft. and 5½ ft. brick sewers, $3.80 and $3.85 per ft.; asphalt paving, $2.80 per sq. yd.; cedar block paving, $1.37 to $1.70 per sq. yd.; granite paving, $3.62 per sq. yd.; masonry, $4.50 and $5; 27-in. brick sewer, $2.05; 21-in. pipe, $1.48 and $1.44; 18-in. pipe, $1.05 and 84 cts.; 15-in. pipe, 90 cts. and 78 cts.; 12-in. pipe, 75 cts. and 67 cts.; manholes, $34 and $36 each; catch basins, $45 and $48 each.

Leavenworth, Kan.—The City Council has awarded contracts at the following prices: grading, 17¾ cts. and 19½ cts.; tiling, $1.82; masonry, $3.50; culvert excavation, 40 cts.; culvert masonry, $3.24.

Ingersoll Rock Drills.—The following letter explains itself and shows an excellent record of rock-drilling The Standard Cement Co., of Akron, N. Y., write: "We are running four 3½-in. 'Ingersoll Eclipse' Drills, 10 hours per day, in a 7 ft. tunnel. No vertical drilling. Holes start at 2¼ ins., second bit 2 ins., finishing bit., 1¾ ins. Average depth, 4 ft. 6 ins. Power used—compressed air.

"A fair average of our drilling month after month is exhibited in the following:

"Aug. 1st	446 ft.	Aug. 7th	456 ft.
" 2nd	436 "	" 8th	448 "
" 3rd	446 "	" 9th	436 "
" 4th	416 "	" 10th	448 "
" 6th	428 "	" 11th	436 "
	2,172		2,224

"For 10 days, total feet, 4,396. Average per day for each drill, 109⅞ ft.

"The drilling is mostly at an angle of 45°, both upward and downward. Rock seamy, with shelly layers."

The Ingersoll Company report their new air compressor as meeting with much favor. Two large machines 20 x 30 ins. have recently been shipped to the Louisville Water-Works, and another is to be used by the Kalamazoo Spring & Axle Co. for spraying oil in connection with fuel atomizers. The Arminius Copper Mine Co., of Tallersville, Va., write that the new regulator works like a charm, and unlike the mere throttling device in most compressed air regulators, automatically applies and releases the load, and saves much fuel and is regular in action. Another improvement is in the crosshead, which is now so arranged that wearing of the crosshead in the guides does not bring the weight of the crosshead on the rods. The same company have also recently built a new coal-cutter, designed by Mr. H. C. SERGEANT. It is in operation in the mines of the St. Bernard Coal Co., at Irvington, Ky. It operates on the principle of a rock-drill; is powerful and durable, and the reports from the St. Bernard mines state that the machine will run on less power, require less volume, strike a harder blow and a greater number of blows per minute than any percussion cutter they have tried.

Street Work.—*Brooklyn, N. Y.*—The following proposals for granite paving and street improvement have been received by City Commissioner ADAMS. The contracts have been awarded to William Kelly, at an aggregate of $246,880.

Washington Street.

William Kelley	$13,513.40
John H. O'Rourke	14,813.40
John Hart	15,158.00
Charles Guidet	16,401.40
Daniel J. Creem	16,980.00
Thomas McCann	17,190.00

Washington and Underhill Avenues.

Daniel J. Creem	$141,100.00
Harris & Maguire	121,974.00
John H. O'Rourke	118,770.00
Thomas Monahan	117,740.00
John Hart	114,070.00
Charles Guidet	112,490.00
William Kelley	104,340.00

Bond, Nevins and Butler Streets.

Daniel J. Creem	$70,577.50
Daniel Gallagher	61,178.75
Harris & Maguire	60,851.15
Patrick Gorman	60,040.60
Thomas McCann	56,381.00
Charles Guidet	54,737.56
John Hart	52,041.70
John H. O'Rourke	51,330.15
William Kelly	50,972.40

Van Brunt Street.

Daniel J. Creem	$60,750.00
Thomas Monahan	60,050.00
Charles Guidet	52,620.00
John H. O'Rourke	50,350.00
John Hart	47,340.00
William Kelley	43,720.00

Manhattan Avenue.

Daniel J. Creem	$42,355.00
Thomas Monahan	42,247.00
John H. O'Rourke	39,888.00
John Hart	38,373.00
Charles Guidet	38,330.60
Thomas Newman	35,912.80
William Kelly	34,334.20

The contract prices are as follows, in order as above: granite block paving, $2.33, $2.65, $2.47, $2.37 and $2.30 per sq. yd.; line of improvement (widening), 8 cts., 40 cts., 10 cts., 23 cts., and 8 cts. per lin. ft.; new curb, 55 cts., 60 cts., 55 cts., 55 cts., 55 cts., per lin. ft.; new bridge stone, 43 cts., 55 cts., 45 cts., 45 cts., 43 cts. per sq. ft.; reflagging, etc., 2 cts., 10 cts., 3 cts., 3 cts. and 2 cts. per sq. ft.

Crib Work.—The following proposals for building two cribs for protecting the shore line at Sturgeon Point light station, Michigan, have been received by Col. S. M. MANSFIELD, U. S. Lighthouse Engineer: 23,832 ft. B. M. of pine lumber, A. J. Dupins, of Detroit, Mich., $22 per M., and Luther E. Allen, of Charlevoix, Mich., $15 per M.; 100 lbs. of boat spikes, 4½ cts. and 6 cts.; 180 lbs. of screw bolts, 5 cts. and 6 cts; 280 lbs. of wrought iron washers, 5 cts. and 6 cts.; 1,000 lbs. of cut steel nails, 3 cts. and 6 cts.; 20¼ cords of stone ballast, $9 and $12; 23,832 ft. B. M. of framing, $12 and $15 per M.; totals, $1,050.70 and $1,052.40.

The following proposals for rebuilding the superstructure of the crib surrounding the keeper's dwelling at the Racine, Wis., light station, have also been received by Col. S. M. MANSFIELD: W. T. Casgrain, Milwaukee, Wis.; 115,056 ft. B. M. of pine lumber, $16.75 per M.; 17,000 ft. B. M. of pine plank, $15 per M.; 12,000 lbs. of drift bolts, 3½ cts. per lb.; 1,400 lbs. of spikes, 4½ cts. per lb.; 160 cords of stone ballast, $8 per cord; 132,056 ft. B. M. of framing, $15 per M.; 251 lin. ft. of picket fence, 40 cts. per ft.; total, $6,026.43. Knapp & Gillen, Racine, Wis.; lumber, $16; plank, $14; bolts, 4 cts.; spikes, 5 cts.; ballast, $10; framing, $15; fence, 52 cts.; total, $6,340.25; C. H. Starke, Milwaukee, Wis.; lumber, $17; plank, $14; bolts, 4 cts.; spikes, 5½ cts.; ballast, $10.50; framing, $17; fence, $1.25; total, $6,989.65.

Bridge and Approach.—The following proposals for the superstructure of and timber approaches to the Broadway bridge across Cherry creek, 130 ft. span, have been received by H. M. LANE, Constructing Engineer, Denver Tramway Co., Denver, Col.: Superstructure; P. E. Lane, La Salle St., Chicago, $7,287; King Iron Bridge & Mfg. Co., Cleveland, O., $8,627; Milwaukee Bridge Co., Milwaukee, Wis. (C. E. H. Campbell, Council Bluffs, Ia.,) $8,950; Shiffler Bridge Co., Pittsburg, Pa., $9,325; Missouri Valley Bridge & Iron Co., Leavenworth, Kan., $9,600; H. A. Tullock & Co., Leavenworth, Kan., $11,500; Lomas Bridge Co., Cincinnati, O., (informal).——Timber approach and piling foundation for yokes and masonry; F. P. Cole, Denver, 34 cts. per lin. ft. for piling, 7 cts. per lb. for wrought-iron, 4 cts. per lb. for cast-iron, $32.50 per M. for native yellow pine or New Mexico pine, $39 per M. for Texas yellow pine, $7 and $3 per M. respectively for putting down and taking up old timber; R. Jackson, Denver, 37 cts. for piling, $32.50 for native pine, 6 cts. for wrought-iron, 4 cts. for cast-iron; Rosenfeld Construction Co., Pueblo, (R. W. Waddell, Denver), 55 cts. for piling, $43.50 for Texas yellow pine, 5½ cts. for wrought-iron and cast-iron.

Grading and Sewers.—The following proposals have been received by JULIUS PITZMAN, engineer in charge of improvements for the Catlin Land & Improvement Co., St. Louis, Mo.: Grading; 223,000 cu. yds.; P. D. Sage, St. Louis, 16⅞ cts. per cu. yd.; E. M. Rothwell, St. Louis, 20⅝ cts.; Thomas Whelan, St. Louis, 22 cts.; Keene Bros. Construction Co., 23 cts.; Judge & Strang, Kansas City, 23½ cts.; Fruin-Bambrick Construction Co., St. Louis, 23½ cts.; J. J. Randall, Carlisle, Ill., 26½ cts.; Sharp & Meyers, Carlisle, Ill., 28 cts.——Sewerage; the contract was let to J. C. HEMAN, of St. Louis, at the following prices, 4,000 cu. yds. of earth excavation, 22 cts.; rubble masonry, $4 per cu. yd.; 1,085 cu. yds. of brick masonry in open cut $7.50; 36 x 48-in. brick sewer, $2.75 per lin. ft.; 30 x 42-in., $2.20; 24 x 36-in., $2.25; pipe sewer, $1.85 per ft. for 24-in., $1.50 for 21-in., $1.30 for 18-in., 70 cts. for 15-in., 65 cts. for 12-in. and 10-in., 50 cts. for 8-in.; $300 for 44 18-in. pipe inlets, $200 for 10 manholes, $8 for two 24-in. pipe inlets; total, $19,619.50. The other bidders were: P. D. Sage, St. Louis, $20,267.35; Thomas Whelan, St. Louis, $20,344.60; Heman & Prendergast, St. Louis, $23,376.75; W. Skrainka & Co., St. Louis, $24,971.50; R. Sheehan, St. Louis, $25,880.

Water-Works.—*Vinton, Ia.*—The contract for the works complete, except water supply, has been awarded to Dennison & Cowell, of Muscatine, Ia., at $22,450. The next lowest bidders were, W. P. Whitten, of Sioux City, Ia., $22,657.50, and E. T. Sykes, of Minneapolis, Minn., $22,867. There were 27 bids received altogether. LOWETH & CURTIS, of St. Paul, Minn., are the engineers. There will be one artesian well, engine house, 2 boilers and stack, one duplex high pressure, pumping engine of 1,000,000 galls. daily capacity, one duplex, compound, condensing pumping engine of 500,000 galls. daily capacity, and about 15,000 ft. of 4, 8 and 10-in. cast-iron or kalamein pipe, with specials, valves and hydrants.

Superior, Neb.—The contract for the water-works has been awarded to S. K. Felton, of Omaha, Neb., for $25,000; the highest bid was $29,498.96. The amount of material is as follows: 2,150 ft. of 10-in. pipe, 2,920 ft. of 8-in., 4,220 ft. of 6-in. and 4,590 ft. of 4-in.; there will be 9 valves and 20 hydrants furnished by the Chapman Valve Co. The pumping plant will consist of one Deane compound pumping engine with a daily capacity of 500,000 galls., steam cylinders 8 ins. and 12 ins., water cylinder 7 ins., stroke 10 ins., also one high pressure Deane steam pumping engine with a daily capacity of 1,000,000 galls., 16-in. steam cylinder, 10¼-in. water cylinder, 10-in. stroke. The water supply will be obtained from an open well 25 ft. diameter and 30 ft. deep. W. KIERSTED, of Kansas City, Mo., is the engineer.

Lebanon, Ky.—All the proposals given on page 157 have been rejected and the work is readvertised. (See advertising pages this week). The advertisement calls for supply well; building and chimney; pumping machinery and boilers; 8-in. rising main, 8,500 ft. long; storage reservoir, capacity, 1,250,000 galls.; 10-in. supply main to city, 12,150 ft. long; 350 ft. of 42-in. pipe, 1,080 ft. of 10-in., 3,480 ft. of 8-in., 11,790 ft. of 6-in. and 5,520 ft. of

4-in.; three 10-in. and four 8-in. valves; one 8-in. check valve; 40 fire hydrants; also pipe-laying and everything necessary for the construction of a complete system of water-works. Proposals will be received for pumping machinery (horizontal or vertical) with a daily capacity of 1,000,000 galls. pumped to the reservoirat an elevation of 480 ft. from Rolling Fork creek, the source of supply. J. D. COOK, of Toledo, O., is Consulting Engineer. A. OFFUTT is Chairman of the Water Board, Lebanon, Ky. Proposals will be received until Sept. 19.

Naugatuck, Conn.—The Naugatuck Water Co. has awarded contracts as follows: pipe and specials, about 1,000 tons, to R. D. Wood & Co., of Philadelphia; valves and hydrants, to Ludlow Valve Mfg. Co., of Troy, N. Y. Proposals will be received until Sept. 8 for laying about 1,000 tons of 4, 6, 8 and 10-in. cast-iron pipe and appurtenances; about 250 tons to be laid before Dec. 1, and the remaining 750 tons to be laid before June 1, 1889. T. H. MCKENZIE, of Naugatuck, is Engineer for the company.

Filter Plant.—***Jersey City, N. J.***—The following proposals for furnishing a filter plant for purifying the water supply of the city, were received Aug. 27, by the Board of Public Works. The plant is to be delivered, erected, connected and put in complete running order at or near the Belleville pumping station, and must have a guaranteed capacity of 25,000,000 galls. per day.

Philadelphia Water Purifying Co., Philadelphia, Pa.: Submitted plans and specifications of a water purifying plant to be erected at the reservoir of Belleville pumping station, with a guaranteed daily capacity of 25,000,000 galls. for $210,000. This price includes the plant and maintenance for 2 years, erection of cottage, laying 3-in. pipe from reservoir to pumping station, water aerating device and electric device for indicating the water level in the reservoir. The proposal guarantees to render the water supply as pure as, if not superior to any other water purifying system.

American Filter Co., Chicago, Ill.: Plant for filtering, aerating and purifying the water supply, with a capacity for treating 30,000,000 galls. per day, $250,000, including connections. Specifications, drawings and a pamphlet accompany the proposal. Time of completion, 1 year or less.

Hyatt Pure Water Co., Newark, N. J.: Plant for filtering and aerating 25,000,000 galls. per day, with apparatus for introducing a proper coagulant before filtration, and including buildings, connections, etc. The price, if the plant is situated near the river, is to be $350,000, or if located adjacent to the Belleville reservoir, $375,000.

Jewell Pure Water Co., Chicago, Ill.: A plant of Jewell's patent water purifiers with a daily capacity of 25,000,000 galls., complete, with buildings, Worthington engines, etc., $263,975. A trial of 60 days allowed, and if the guarantee is not fulfilled, the plant will be removed. The engines will have 2 high pressure steam cylinders 19¼ ins., 2 low pressure cylinders 33⅜ ins., and 2 double acting water plungers 32 ins. diameter; stroke 24 ins.

Hegeman & Oliphant Filter Co., New York; Plant of "Oliphant" filters of sufficient capacity to filter or purify 25,000,000 galls. per day, with building of sufficient size to accommodate plant to increase the capacity 10,000,000 or 20,000,000 galls. per day in the future when necessary; $275,000, and $7,000 for each additional 1,000,000 galls. for future increase of capacity. Cost of maintenance estimated at $1,000 to $3,000 per year. The price includes dwellings.

U. S. Sanitary Filter Co., New York; Complete plant for filtering and purifying 25,000,000 galls. of Passaic river water; consisting of 11 "Sectional" filtering machines, with aerating attachment and steam cleaning apparatus, one receiving and distributing tank 24 ft. diameter and 26 ft. deep, in which the water is aerated, two coagulating and purifying tanks, engine, boiler, pipes, appurtenances and connections, $250,000. The cost for maintenance is estimated at $12,000 per annum, or $1.32 per 1,000,000 galls. of filtered water.

The contract will not be awarded until due consideration is given to the several bids, with their accompanying specifications.

WATER.

Frederick, Md.—A break occurred in the western wall of the storage reservoir on Aug.13,and a quantity of water flowed over the adjacent fields. The fire plugs in the city were opened and the water was drawn off.

Stand-Pipe.—The Trustees of the water-works at Jackson,Tenn.,contemplate erecting a stand-pipe, and correspondence is invited on the subject. W.T.HARRIS, Secretary, will be glad to furnish any information desired by interested parties.

Lawrence, Kan.—It is reported that the gas company has purchased the electric light plant of the water-works company, and has now a complete monopoly of the light of the city. It owns the Edison incandescent, the Thomson-Houston and the gas light, Their first move was to raise the price of light, and it is rumored that they are trying to get a corner on the coal oil market. The merchants are vigorously protesting.

Brooklyn, N. Y.—Corporation Counsel JENKS has decided that a portion of the $300,000 to be spent on improvements in Prospect Park can be used to purchase an electric light plant.

Drainage at Hyde Park, Ill.—Extensive operations on the Woodlawn Park drainage project have been commenced. A large force of men is at work building the pumping works and laying the mains.

San Diego, Cal.—The well sunk in the Otay river by the San Diego & Coronado Water Co., is yielding 30,000 galls. per day. The well is 18 ft. deep and 26 ft. in diameter; lined with brick. When the water-works are completed, 1 000,000 galls. per day will be supplied. W. R. COATS is the engineer.

Water Waste Detection.—At Montreal, Canada, the Water Department has instituted a system of night inspection for detecting waste, the foreman going round three nights a week. The plan has been very effective.

Allegheny, Pa.—The Water Committee has been considering the question of improving the water supply and several filter systems have been proposed. The gang-well system has also been proposed and the discussion of the filter question has been deferred for two months in order that the system of gang-wells put down by Andrews Bros., at Albany, N. Y., may be investigated.

Natural Gas in Pennsylvania.—A consultation of McKeesport and Pittsburg capitalists and the officers of the Bellevernon Gas Co., w s held at the latter place recently with a view to running a pipe line from Bellevernon to McKeesport by way of Monongahela City and Elizabeth.—The Fayette City Natural Gas Co., has contracted with the Bellevernon Heat & Light Co., for Fayette City. The council has granted the company all the privileges asked and has made a fair proposal to the company to light the streets.

The Minnesota Natural Gas Co. has applied for an exclusive franchise at St. Paul, Minn. The proposed franchise is to give the company an exclusive right for fifteen years to construct a natural gas plant and lay pipes through the streets, alleys and lanes of the city. At the expiration of the fifteen years the city council is given the option to purchase the entire plant. After the plant has been in operation for five years the city council has the right to control its rates.

Albany, N. Y.—The iron receiving tank for the new driven well system of water supply has been received, it is 11 ft. high, 11 ft. diameter, built of 1¼-in. iron, and weighs 10 tons. It was built at the West Point Foundry. The five openings through which the water will flow from the conduits into the tank are each 38 ins. in diameter. The opening through which the water will flow into the conduit leading to the reservoir on the hill is 44 ins. in diameter. Owing to the delay in shipping the tank, the quality test will probably not begin until the second or third week in September. During the three months during which the quality test continues, 15,000,000 galls. of pure, sparkling water will be pumped daily into the river just east of Pleasure Island. The quantity test will be continued for one year, including the three months quality test.

Fulton, N. Y., Sewerage.—The Village Trustees have adopted a resolution that sewers be constructed in accordance with the plans which were drawn by State Engineer J. T. GARDINER, of Albany, and received by the trustees in 1887. The plan is to have a sewer on each street between and including First and Sixth St. and also on all between and including Pratt and Erie St. An application will have to be made to the County Judge to appoint commissioners, who will assess each property owner who will receive benefit from the system according to the number of feet of his property fronting on the sewer. This will pay the costs of constructing the sewer, and the expense will be confined to those whose property is within the sewer district. It is estimated that the sewerage will cost about $25,000. The main sewer will be on Second St. Although the plan is to have one on First St., it is though very improbable that one will be constructed there because the entire length of it would have to be blasted out of solid rock; and also on this street it is needed the least because nearly all the houses are now connected by private sewers with the river. The work of constructing the sewers will begin this fall.

Irrigation Tunnel.—Work is soon to be resumed, says the Reno *Journal*,on the tunnel which is to tap Eagle lake, Lassen Co.,Cal. The tunnel is being run by P. N. MARKER, of Nevada, and Captain C. A. MERRILL, of California. The lake will give a flow of 780,000,000 galls. per day, and will irrigate 150,000 acres of land now lying uncultivated for the want of water. The lands to be irrigated are on the borders of Honey Lake valley, the central part being irrigated by Susan river. Within the past year there have been constructed in Lassen Co. no fewer than half a dozen reservoirs. These cost from $5,000 to $6,000 each and hold from 5,000,000 to 40,000,000 galls. of water. These reservoirs have more than doubled the value of many ranches

Water-Works.—***Connecticut.***—New Haven. The New Haven Water Co. has obtained entire control of the important water supply in Woodbridge and the natural water-shed in the region. Buying has been going on for several weeks a nd a large tract has been obtained from the different proprietors. This is the last remaining water supply in the vicinity of New Haven and will give an additional storage of 12,000,000 galls. of fine water.—Windsor Locks. The water company held a meeting recently but failed to perfect a permanent organization and the water supply question is still in abeyance.

Massachusetts.—Whitman. The new system of water supply, taken from a well near Hobart pond, is said to be not wholly satisfactory, although it is yet only experimental. It has been suggested that the Bridgewater mains might be extended from East Bridgewater to Whitman, as the question of a supply from the Big Sandy river is not favorably considered.

New York.—Olean. At the special election to vote upon the proposition to issue bonds in the sum of $12,500 for water-works improvements, there was a majority of 54 in favor of the proposition. The appropriation will be used for the purchase of an improved Gaskill pump and the necessary enlargement of the pump-house.

Virginia.—Norfolk. The city has appropriated $8,500 for a test of a gang-well system of water supply.

Tennessee.—Guthrie. The Louisville & Nashville R. R. Co. is laying pipe from the Meriwether springs, 2½ miles distant; the water is for supplying the locomotives, and in return for the right of way the company will furnish the town with water.

South Carolina.—Aiken. A local water company will be organized if the city will contract for a certain number of hydrants.

Georgia.—Macon. The Macon Gas Light & Water Co. will construct a new reservoir.—Rockmart. The Rockmart Land & Improvement Co. proposes to build water-works.

Alabama.—Mobile. The city's new contract with the Bienville Water Supply Co. is for 260 hydrants, and not 265 as stated last week.

Louisiana.—Baton Rouge. The Baton Rouge Water-Works Co. has commenced the construction of its steel stand-pipe, 100 ft. high.

Mississippi.—Vicksburg. Work is progressing on the water-works and it is expected to have them completed by the end of September or the middle of October. Capt. C. DELAFIELD is Chief Engineer, and M. MCFARLAND is Resident Engineer.

Michigan.—Lapeer. The new water-works have been tested and accepted by the city.

Minnesota.—Winona. Work has been begun on a new well for the city water-works; it will be 38 ft. deep, and 50 ft. diameter. The present well has a capacity of 2,000,000 galls., and it is intended that the new well shall have a capacity one-third greater.—St. Cloud. The water-works were tested Aug. 20, and 7 streams were thrown 100 ft. high and 2 streams 125 ft. The works cost $120,000 and are owned by Minneapolis men.

Missouri.—Washington. The Interstate Gas & Water-Works Co. is pushing the construction of the water-works, and expects to have them completed by January 1, the contract date.

Kansas.—Smith Center. The city has voted to issue bonds for $25,000 for a system of water-works. The supply will be drawn from wells and pumped to a stand-pipe.—Lawrence. According to report the City Council has passed a resolution rejecting the bill of the water company for hydrant rental till July, 1889, and deciding not to pay such rental until the company furnishes the city with good water according to contract.

Oregon.—Medford. J. S. HOWARD is piping water to a reservoir from a creek 2½ miles distant.—St. John's. T. A. COOK, of Portland, has been making estimates of the cost of putting up water-works in St. John's. There are four wells in the place, and those that have been sunk are very deep. His plan is to sink a well on the hill above town and pump into a tank or small reservoir. An abundance of pure water can be obtained by sinking a well deep enough. Mr. Cook thinks a pump with a capacity of about 1,000 or 1,500 galls. an hour would answer for the present. The plan is to raise the money for the enterprise from the people of St. John's. It is thought it would cost about $1,000 to dig the well, put up the tank and pump. Then would come the expense of laying the mains. It is likely that a joint stock company will be organized to carry out the enterprise.

Washington Territory.—Vancouver. The government barracks will be supplied with water from an artesian well put in at government expense, as soon as the necessary pipes, etc., can be laid. Pipe has been received, and a large reservoir is in process of building. The plant will cost some $25,000, including 20,000 ft. of main pipe, and the necessary branches and fittings. The monthly water rate thus to be saved is $500, hitherto paid to the Vancouver local government.

California.—Sacramento. The Central Pacific R. R. Co. will shortly construct private water-works for the purpose of supplying its shops. The water now used for drinking purposes is brought from Blue cañon, but owing to the great number of men employed in the shops, the demand exceeds the supply. The new supply will be drawn from a well.

Texas.—Weatherford. The Weatherford Water, Ice & Light Co. is laying pipe, and has let a contract for erecting a building.

Canada.—Welland, Ont. On Aug. 30 a vote was taken

on the by-law for supplementary water-works, granting $16,000 for that purpose.

Sewerage.—*Manchester, N. H.*—An 8 in. sewer is being laid on Amherst St. to connect with the 30-in. cement sewer on Union St.

Northampton, Mass.—The Sewer Commissioners have engaged C. E. BOWDITCH, C. E., of Boston, to investigate the sewerage system.

Owensboro, Ky.—A sewerage system is contemplated and will probably be built under the supervision of Mr. SCOWDEN, City Engineer of Louisville.

Wilmington, N. C.—The city contemplates commencing work on the sewerage system this season. Surveys and plans have been made, and the cost is estimated at $100,000. For information address the mayor.

Rome, Ga.—The present sewerage system is incomplete and inefficient, and it is proposed to improve it and make it thoroughly efficient.

Armourdale, Kan.—Sewer district No. 5, has been established by the city council and will be composed of a majority of the territory in Armourdale and Armstrong. The main sewer will be placed along 16th St., from the bluff in Armstrong to the river. It will be from 4 to 8 ft. in diameter, and will be built of brick. A sub sewer system will be eventually laid all over this city and a large portion of Armstrong. The main sewer will cost about $58,000, and will be completed in four months. The citizens are very much in favor of the sewerage system.

Portland, Ore.—The system of sewers at the south end is all completed, the last two, in Lincoln and Grant Sts., having been accepted. The city is pretty well sewered now, there being a sewer in every street from G to Carruthers. The contract has been let for a sewer in H street, the council has authorized one in M street, and a petition is before the council for one in N St. This list does not include the big brick sewer in Marquam's gulch, nor the Tanner creek sewer, the largest by far in this city.

Los Angeles, Cal.—It is proposed to build an outlet sewer at a cost of $300,000.

Montreal, Canada.—The municipality of St. Henry has decided to put in an efficient drainage system, and will issue $110,000 in 25-year debentures.

Artesian Wells.—*Middletown, Conn.*—The artesian well put down by Judge CALEF has struck a fair supply of water at a depth of 80 ft.

West Liberty, Ia.—The artesian well is flowing 1,750 barrels of good water per day. It is now 1,360 ft. deep and drilling is being continued.

Harold, Dak.—The artesian well is about 900 ft. deep.

Pueblo, Col.—A fine flow of water has been struck by the second artesian well at Columbia Heights, at a depth of 789 ft. The well is 6 ins. in diameter, the largest bore of any well in the city. The water is of good quality.

Salida, Col.—The new Board of Directors of the Artesian Well Co. are getting in money from parties who had delayed paying their subscriptions, and are also obtaining new subscriptions. Work has been resumed on the well.

Ritzville, Wash. Ter.—The artesian well project is still delayed, but it is said that negotiations are being made with Allen & Crowley, of Walla Walla.

Delano, Cal.—A number of artesian wells have been started in and around the town.

Corpus Christi, Tex.—The American Well Works Co. has begun operations for an artesian well on the city square. The contract is for a flow of 50,000 galls. per day, but a greater flow is expected.

Hillsboro, Tex.—The well is now 350 ft. deep, and the contract is for 600 ft. for $1,000, if water is not obtained at a less depth.

Ladonia, Tex.—An artesian well is to be sunk, and correspondence is invited. Address Lock Box 18.

Oswego, N. Y.—The City Council has renewed the contract with the Oswego Water-Works Co., for water supply for 15 years at $15,000 per year; the amount paid last year was $25,807 under the old contract. The new contract includes the supply for 185 fire hydrants, 18 drinking fountains and for other public uses. The company agrees to maintain the capacity of the present system for a term of 15 years, dating from July 1, 1888, and to supply pure water from the Oswego river at or near the high dam, for public purposes, that is to say to supply all the present fire hydrants with water from the reservoirs, and with direct pressure when required by the fire department. Additional hydrants may be ordered by the city, for which a rental of $50 each per annum will be paid; extensions of the pipe system may also be ordered within the first eleven years of the contract. The supply for public and private use is not to be less than 2,000 galls. per minute, and sufficient to furnish an ample supply for steam fire engines when necessary.

Albion, N. Y.—The new water-works at Albion, N. Y. are nearly completed. The wells from which the supply is to be taken are flowing wells, and furnish a very clear, soft water. The water in these wells will mount 2 ft. above the surface of the ground. The village will pay $3,000 rental per year for water for fire protection.

Gas Works.—*New Bedford, Mass.*—The New Bedford Gas Light Co. has increased its stock to $300,000 and will put in more electric lights.

Albany, N. Y.—The Municipal Gas Co., will increase its capital stock from $1,000,000 to $1,500,000 and will, purchase the plant of the West Troy Gas Co.

Tonawanda, N. Y.—The Tonawanda Gas Co. has been incorporated by BENJAMIN L. RAND, A. J. HATHAWAY, F. GETZ, and others. Capital stock $25,000. The company has rights to use natural gas or electricity.

Richmond, Va.—The City Council has appropriated $2,500 for increasing the generating capacity of the city gas works. A water gas plant will be put in.

Mankato, Minn.—The gas works were sold by the receiver at public auction Aug. 23, and were purchased by H. M. Hamilton; the total cost will be about $42,000.

Baker City, Ore.—Gas works are to be put in at a cost of $25,000. L. L. BROMWELL, President of the California Insurance Co., is interested.

Electric Light.—*Gardiner, Me.*—The Augusta Electric Light Co. has purchased the electric light and gas plants, and the electric light is now operated from the power station at Augusta.

Monson, Mass.—The Palmer Electric Co., of Palmer, Mass., contemplates extending its line to Monson.

Lansinburg, N. Y.—The Union Electric Light & Power Co. has been incorporated by J. K. P. PINE, ISAAC G. FLACH, WM. VAN KLEECK, etc. Capital stock, $100,000.

Jamestown, N. Y.—The two electric light companies have been consolidated. President, CHAS. W. GRANT; Secretary, CHAS. H. TEW.

Summit, N. J.—The Township Committee has awarded the contract for street lighting to the New York & New Jersey Gas Light Co., for $2,300 for the ensuing year.

Annapolis, Md.—The city has accepted the proposition of the Annapolis Electric Light Co. to light the city for $3,500 per annum for 2 years. The company has contracted for a Thomson-Houston plant for 100 lights.

Spartanburg, S. C.—The Spartanburg Gas, Electric Light & Power Co. has been incorporated to acquire the gas works and establish an electric light plant. Capital stock, $30,000. Address H. E. HEINITSH.

Macon, Ga.—The Macon Gas Light & Water Co. will put in a Thomson-Houston plant, which is to be in operation by October.

Meridian, Miss.—The city has granted a franchise to the Thomson-Houston Electric Light Co.

Natchez, Miss.—The Natchez Gas Co. proposes to put in an experimental Thomson-Houston electric light plant, with a view to establishing it permanently when the gas contract expires.

Chicago, Ill.—The Consumers' Electric Light Co. has been incorporated with a capital stock of between $100,000 and $200,000.

South Chicago, Ill.—The Globe Light & Heat Co. is endeavoring to secure a franchise for street lighting.

Helena, Mont.—The Citizens Electric Light Co. has been incorporated by WM. B. STERLING, JOHN WORTH and H. STERLING. Capital stock, $50,000. The Thomson-Houston system will be used.

Ellensburg, Wash Ty.—The electric light plant is nearly completed; it is being put in by D. THIERY, of Seattle.

Salinas, Cal.—The Salinas Gas & Water Co. has contracted for a 31 light Thomson-Houston plant.

Gainesville, Tex.—The Gainesville Electric Light Co.'s charter, as amended, fixes the capital at $30,000.

New York, N. Y.—The Gas Commission has awarded contracts for lighting Stuyvesant square with electric lights to the East River Electric Co. and the United States Electric Co. The lights are to burn all night.

A Reservoir in Danger.—The Long Island Water Supply Co. has obtained an injunction restraining the owner of land adjoining the reservoir property from making dangerous excavations near the company's reservoir on Reservoir hill near Newtown, N. Y. The company fears that if the defendant, who is using the earth in filling the valley below the reservoir, continues the work of excavating, that the walls of the reservoir, deprived of their support, will give way, and that the adjacent lands will be flooded. The Long Island Water Supply Co. was organized in 1882, to furnish water to the town of New Lots, now the Twenty-sixth Ward, Brooklyn, N. Y. It purchased a plot of land 1,000 by 200, on Reservoir hill, and in the center of the plot is the reservoir, a basin 440 ft. wide, 115 ft. wide, and 17 ft. deep. Its capacity is 4,000,000 galls. It was constructed by digging out the earth and facing the sides and bottom. The defendant owns the land on the westerly slope of the hill and has been excavating there for some time to a depth of 23 ft. The company claims that if the work is continued the side of the reservoir will fall and the water will escape, inundating the surrounding land, doing considerable damage to property and possibly to life and, at the same time, depriving the town of New Lots of water for public or private use.

Helena, Mont.—The City Council has been contemplating calling for bids for a water supply, and at a recent meeting a communication was read from GEO. F. WOOLSTON. It contained a full and complete history of the inception and progress of the works of the Helena Water Co., and stated that but for the action of parties interested in the "Old Water Co." the city would now be paying $15,000 per year as rental of hydrants for fire purposes. The $15,000 was necessary for the support of the plant, and the works would never have been built unless he had relied on the faith of the city to pay that sum. Now his company was asked to furnish bids for supplying water, and to compete with companies having a gravity system and at no expense for pumping water. His company, in order to do the work economically, must supply all districts of the city and not portions. If the case now pending in the courts regarding the validity of the first ordinance (No. 93) was decided in favor of his company, the city would be compelled to pay for the water twice, if a contract was now made with any company other than his. The communication then asked that the action of the Council in calling for bids for water supply be reconsidered. Mr. WOOLSTON stated that his company had invested $350,000 upon his representations, and he wanted them to be treated fairly, and met in the same spirit that the Council of 1887 had met them; that the rental of $15,000 was necessary to maintain the proper supply of water Helena needed, and that his company would spend $25,000 for additional mains if they received contract. After considerable discussion the question of calling for bids was lost, and a motion to refer the matter to the Committee on Water was carried.

RECORD OF NEW WATER-WORKS CONSTRUCTION.

(Specially Communicated.)

(CONTINUED FROM PAGE 158).

Franklin, O.—The works were commenced in January, 1887, and completed in July, 1888. They were designed by JOHN W. HILL, M. E., of Cincinnati, O., who was also Constructing Engineer. The contractor for masonry, foundations and buildings, was J. D. Hendrickson, of Franklin; for pumping machinery, Holly Mfg. Co., of Lockport, N. Y.; for pipe and specials, New Philadelphia Pipe Works, New Philadelphia, O.; for trenching and pipe laying, Snyder & Williams, of Dayton, O.; for valves, Eddy Valve Co., of Waterford, N. Y.; for hydrants, R. D. Wood & Co., of Philadelphia, Pa. The supply is drawn from six driven wells, 6 ins. diameter and 64 ft. deep, connected with 6, 8, and 12-in. pipe, now supplying about 1,000,000 galls.; the water is pumped direct by two compound, duplex, direct acting pumps, with a daily capacity of 750,000 galls. each. There are 6 miles of mains, 60 hydrants and 50 meters; the mains are of cast-iron and the services of lead. Ordinary pressure, 40 lbs; fire pressure, 100 lbs. Cost of works, $45,000; debt, $45,000; rate of interest, 5 per cent. Bonds for $45,000 are issued. The works are owned by the town and controlled by a Board of Trustees, consisting of C. M. ANDERSON (Chairman), WM. MICHAELS and N. W. EARHART. The present population is 3,500. (Date of special report; August 10, 1888.)

Findlay, O.—The works were commenced in April, 1888, and are to be completed in January, 1889. They were designed by JOHN W. HILL, M. E., of Cincinnati, O., who is also Constructing Engineer. The contractors were as follows: For masonry, Houston & Freeman, of Cincinnati; for foundations and buildings, Cassidy & Murray, of Cincinnati; for pumping machinery, Gordon & Maxwell Co., of Hamilton, O.; for pipe and specials, Addyston Pipe & Steel Co., of Cincinnati; trenching and pipe laying, Jas. J. Rumsey, of Canton, O.; for valves, Eddy Valve Co., of Waterford, N. Y.; for hydrants, Bourbon Copper & Brass Works, of Cincinnati; for filter galleries, W. H. Campfield & Sons; for masonry dam and storage reservoir, Houston & Freeman, of Cincinnati. The supply is drawn from the Blanchard river, and the water is pumped direct by two compound, duplex, direct acting engines with a daily capacity of 2,500,000 galls. each. The storage reservoir has a capacity of 86,000,000 galls. There are to be 18 miles of 4-in. to 20-in. cast-iron mains, and 139 hydrants. Ordinary pressure, 40 lbs.; fire pressure, 110 lbs. Cost of works, $250,000; debt, $250,000; rate of interest, 5 per cent. Bonds for $250,000 have been issued. The works are owned by the city, and controlled by a Board of Trustees, consisting of B. F. KIMMONS, WM. EDWARDS and P. B. MORRISON. The present population is 20,000. (Date of special report; August 10, 1888.)

(TO BE CONTINUED).